Sand, Rock, and Gravel Plan

LAKE CHELAN

National Recreation Area • Washington

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Sand, Rock, and Gravel Plan

June 1995

LAKE CHELAN

National Recreation Area • Washington

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Introduction and Background

PURPOSE AND NEED

The purpose of this *Sand, Rock, and Gravel Plan: Lake Chelan* is to guide National Park Service (NPS) management and use of sand, rock, and gravel in Lake Chelan National Recreation Area. The plan is in accordance with the *General Management Plan / Implementation Plan Alternatives / Environmental Impact Statement* for Lake Chelan National Recreation Area (NPS 1995) and according to enabling legislation, NPS management policies, and applicable laws and regulations.

This plan was also prepared to help meet specifications of the consent decree negotiated between the National Park Service and the North Cascades Conservation Council (Civ. No. C-89-1342D, U.S. District Court, Seattle, 4/22/91). The consent decree, which was the result of a lawsuit, specified actions that were agreed to for resolving the dispute.

MANAGEMENT GOALS, OBJECTIVES, AND ACTIONS

The conceptual goal of this plan is to limit the use of the resources in the national recreation area so that the natural, scenic, and cultural values of the area can be preserved. To help achieve these goals, the *General Management Plan* specified the following directions for this *Sand, Rock, and Gravel Plan:*

Management Objectives

The management objectives are to allow mining of sand, rock, and gravel in the valley but restrict mining to the Company Creek pit for NPS maintenance and public use and minor reconstruction only and to allow for importing of material from outside the valley for new construction.

Actions

To achieve the above objectives, the following actions will be taken.

All borrow pits other than the Company Creek pit will be examined and rehabilitated to natural-like contours and vegetative cover as appropriate. Mined portions of the Company Creek pit will be reclaimed as new mining of sand, rock, and gravel occurs in order to maintain the active sand, rock, and gravel pit at less than or near its current size. No new borrow sites will be allowed.

Sand, rock, and gravel will be conserved and recycled whenever possible (for example, consider conservation through maintenance and road system design). No sand, rock, or gravel will be removed from the 100-year floodplain of the Stehekin River or its tributaries.

Material for new public or private construction will be barged into Stehekin Valley. Guidelines will be developed to remove nonnative species and other foreign materials before the sand, rock, and gravel is barged.

For routine public and private maintenance needs (road repair, leachfield repair, foundation repair), a limited amount of material at the active gravel pit will be stockpiled. A portion of the stockpiled material will be crushed. Some crushed material will be made available to local residents. The gravel

pit is currently near its maximum size, including the excavated surface and operations floor (space for stockpiling materials and maneuvering equipment).

The plan will use a practical method for allocating sand, rock, and gravel for public use while not depleting the supply for NPS maintenance work. It will also provide for the sale of sand, rock, and gravel at fair market value to local residents only and will regulate the use of this material through the following criteria: (1) the applicant's use must be for maintenance projects only (those *not* requiring a building permit under county laws and regulations); (2) the applicant's use must be within Stehekin Valley; and (3) the applicant's maintenance project must not have a significant adverse effect on the purposes of Lake Chelan National Recreation Area as defined by the *General Management Plan*.

This plan should be reviewed and modified within five years of the first extraction operation to ensure that goals and objectives are being achieved.

HISTORY OF SAND, ROCK, AND GRAVEL USE

The National Park Service is the principal user of sand, rock, and gravel extracted from the Stehekin Valley. In the past, the Park Service used this material for the administrative purposes of the unit, including trail and road maintenance and general construction. The National Park Service extracted material from several sites in the national recreation area between 1968 and 1995. Material has also been extracted from a variety of sites by private citizens, the Forest Service, U.S. Department of Agriculture, Chelan County, and the state of Washington (see the Company Creek Pit Location and Old Borrow Sites map and the "Former Extraction Sites" section, p. 71).

The National Park Service allowed the residents of the Stehekin Valley to extract sand, rock, and gravel from public lands in Lake Chelan NRA for private use between 1968 and 1986. Historically, most private extraction of federal sand, rock, and gravel from public land within Lake Chelan was conducted along the bed of the Stehekin River or its adjacent riparian zone. Types of material and associated uses are drainage rock for sewage drainfields, gravel and sand mixtures for cement aggregate, road bedding and fills, building mortar or bedding material, and some limited use of boulders and stone for building material.

The National Park Service ceased allowing private removal of sand, rock, and gravel from the Company Creek pit in the spring of 1987, after the adequacy of regulations for allowing such use was questioned. The sale of sand, rock, and gravel to local residents was resumed after the Washington Park Wilderness Act of 1988 (P.L. 100-668) clarified the authority for such use. No private extraction of material from public land has been permitted since April 1991, as specified in the consent decree mentioned above. After this plan is approved, private use of sand, rock, and gravel from public land will again be allowed according to the specifications in this plan.

In 1981 the National Park Service prepared an environmental assessment on a proposed site to obtain gravel for administrative and private use. The Company Creek extraction site was ultimately selected because it was located away from primary visitor use areas. Use of that site also made it possible to avoid causing impacts on more sensitive areas such as the Stehekin River. All other extraction sites in the valley were abandoned.

SUMMARY OF PLANNING, REGULATIONS, AND POLICY

This plan and the sections of the *General Management Plan* that deal with sand, rock, and gravel were prepared according to the NPS "Minerals Management Guideline" (NPS-66) and Special Directive 91-6 to ensure conformance with applicable laws, regulations, and policies. Summaries of major environmental protection statutes, regulations, and executive orders that are applicable to, among other things, mineral activities are included in appendix III of NPS-66.

The impacts of this *Sand, Rock, and Gravel Plan* and alternative plans were addressed in the *General Management Plan* (NPS 1995) according to the requirements of the National Environmental Policy Act, the regulations of the Council on Environmental Quality, and the consent decree.

The alternatives ranged from closing the pit and importing material to using material from the pit for most administrative and private uses. The proposed action was chosen in part for the reasons discussed below.

Importing material for all administrative uses was considered impractical because of the high costs and problems associated with transporting large quantities of material. Importing large quantities is constrained by the barge companies' limited capacities for transporting material. Barging is further constrained after lake drawdown when the water is too shallow to dock at the head of the lake. Unloading a barge and hauling large quantities of material near the landing would conflict with other vehicle traffic and visitors using the lower Stehekin Valley Road. Frequent hauling of heavy loads of sand, rock, and gravel from the landing also could damage the Stehekin Valley Road.

Importing material for construction is considered practical because the quantities needed for most individual construction projects will be small compared to maintenance needs. In addition, high-quality construction materials such as angular rock for erosion control or chips for road surfacing are generally not available at the Company Creek Pit.

The following policies are delineated in the NPS *Management Policies:*

> Materials from borrow pits or other sand or gravel sources on NPS lands, including submerged lands, may be used only by the National Park Service in connection with functions necessary for park administration. Superintendents will only create or use new borrow pits or other sources or continue to use existing sources inside the park if it is determined, based on written analysis, that economic factors make it totally impractical to import sand or gravel and if acceptable sources are identified in the park resource management plan.
>
> When the National Park Service must obtain borrow materials or create spoil areas within a park, it will use areas devoid of significant cultural and natural resources, as identified through appropriate studies, and areas not viewed or used by visitors. Such areas will be restored to be compatible with the surrounding environment. All proposals for obtaining materials from a previously unused source within a park will be reviewed under all pertinent environmental statues. (NPS 1988, 9:4)

The sale of sand, rock, and gravel to local residents is authorized by section 206 of the Washington Park Wilderness Act of 1988 (P.L. 100-668), which amends section 402(b) of the enabling legislation for lake Chelan National Recreation Area (16 USC 90c-16b) to read as follows: "Within that portion of the Lake Chelan National Recreation Area which is not designated as wilderness, sand, rock, and gravel may be made available for sale to the residents of Stehekin for local use so long as such sale and disposal does not have significant adverse effects on the administration of the Lake Chelan National Recreation Area." The sale of sand, rock, and gravel will be in accordance with the provisions set forth in 41 CFR 101-47 ("Federal Property Management Regulations"). The requirement to recover costs and charge fees for special park uses comes from title V of the Independent Offices Appropriation Act of 1952 (31 U.S.C. 9701) and OMB Circular A-25 ("User Charges").

There are limited federal regulations for the development of nonfederal minerals on private land. Exceptions are coal (Surface

Company Creek Pit Location and Old Borrow Sites

Lake Chelan National Recreation Area

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Company Creek Pit Location and Old Borrow Sites

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Nine Mile Pits

To High Bridge and Bridge Creek

B Mile Erosion Control Site

Lower Field Pit

Stehekin River

Company Creek Road Erosion Control Site

Battalion Creek Pit

Bear Island Pit

Old Dump

Chelan P.U.D.

Company Creek

Airstrip area

Company Creek Pit

Burn Pile

Frog Island Pit

Rainbow Creek

Golf Course (Topsoil)

School Talus Slope

Rainbow Creek Pit

Boulder Creek

Lower Golf Course Pits

Old Dump

Boulder Creek Pit

Brownfield's Pit

Clark's Pit

To Landing

Lake Chelan

LAKE CHELAN NATIONAL RECREATION AREA

NORTH

0 .5 1 mile

Designated wilderness

Road

Pit or borrow site

Rivers, creeks, and lakes

Mining Control and Reclamation Act, 30 USC 1201), oil and gas (36 CFR 9B), and patented mining claims (36 CFR 9A). For patented claims in the national recreation area, a mine operating plan approved by the National Park Service is required before mining can occur.

Conditions may be attached to permits issued under 36 CFR 5.6 for commercial vehicles used on public roads in connection with developing these nonfederal minerals. Federal environmental protection laws, such as the Clean Water Act, do exist for protecting park resources and values from such development. Reclamation permits are required by the state of Washington for all surface mining activities in accordance with the Surface Mining Act (Revised Code of Washington [RCW] 78.44) for mining operations that disturb areas greater than 3 acres or have highwalls greater than 30 feet high and steeper than 45 degrees. These regulations apply only to nonfederal lands, including private land.

Chelan County also regulates land use activities, including mining, on private land. It is the responsibility of private landowners proposing to mine sand, rock, and gravel on their land to comply with all applicable federal, state, and county regulations.

RESOURCE CONCERNS AND GOALS

Resource Concerns

The primary resource concerns of extracting sand, rock, and gravel from the Company Creek pit are as follows:

- nonnative plants
- aesthetics
- surface water
- dust
- conservation of resources
- cumulative effects

Resource Goals

The resource goals for the extraction of sand, rock, and gravel in Lake Chelan National Recreation Area are to accomplish the following:

conserve use of sand, rock, and gravel at the Company Creek site for future use

reduce resource impacts by consolidating mining activities at the Company Creek pit

provide sand, rock, and gravel at fair market value to private landowners in the valley for routine maintenance

provide sand, rock, and gravel for routine maintenance of public facilities

permanently rehabilitate portions of the Company Creek gravel pit that will no longer be used

after material is removed, revegetate the Company Creek gravel pit once every 10 years

save topsoil at the pit for rehabilitation efforts

avoid establishment of colonies of nonnative plants in the Company Creek gravel pit, including rush skeletonweed, scotch broom, mullein, and knapweed

avoid transferring nonnative plants to other sites in the valley from the Company Creek gravel pit

limit the size of the Company Creek gravel pit and operate the pit so as to reduce its visibility from trails on the other side of the valley

CONSERVATION MEASURES

The estimated average amount of sand, rock, and gravel conserved under this plan will be about 1,400 cubic yards per year if no additional material is imported for maintenance purposes. The conservation will occur through the limits on use and other conservation measures that are discussed below. If additional in-park material extraction is authorized by the superintendent in the event of an emergency, less material will be conserved than has been estimated.

Amounts Used in the Past

Because records of past use are incomplete and weather and flood events are unpredictable, it is difficult to estimate accurately the amount conserved by the following measures. Estimates of past use probably are lower than actual use. Some rough estimates have been provided if data were sufficient.

The National Park Service and local residents have used an average of about 2,800 cubic yards per year since 1948 (see table 5, p. 74). Most of this was used to repair erosion-damaged roads and bridges. The amount used each year has varied greatly, depending on the amount of precipitation and flooding during any given year. About 600 cubic yards per year have been used during mild or normal years to maintain approximately 28 miles of road (21 cubic yards per mile per year). The records on the amount of material used to maintain particular road segments are incomplete. The amounts used for other maintenance and construction activities in the valley are generally unknown.

The upper valley roads are more vulnerable to erosion than most lower valley roads because of higher amounts of runoff, poor road drainage, and steeper terrain. Most upper road segments are not constructed with adequate drainage; they lack shoulder drainage ditches and culverts or roadbed elevation. Some upper road sections act as conduits during spring snowmelt, capturing runoff that washes away much of the gravel road surface. Lower valley road segments adjacent to the river channel, particularly the Company Creek Road and section 8-mile of the Stehekin Valley Road, are also vulnerable to river erosion.

Limits on Use

The National Park Service has estimated the average annual use of sand, rock, and gravel to be 2,800 cubic yards per year. However, the estimate of 2,800 cubic yards per year was based on incomplete records. No estimate of private use of sand, rock, and gravel was available. Private use was estimated to be a percentage of public use based on 3.4 miles of private roads to maintain versus 28 miles of public road to maintain.

To ensure conservation of sand, rock, and gravel, the National Park Service proposes to limit the use of in-park material to 1,400 cubic yards per year: 1,200 cubic yards for NPS use and 200 cubic yards per year for private use over a proposed 10-year excavation cycle — i.e., in the event of a large flood, the remaining 10-year stockpile could be used in one year. Use by the National Park Service will be allowed only for maintenance purposes. Any material needed beyond this limit or for new construction will be imported. Several goals of this plan force us to limit use, including long-term conservation, maintaining the pit in its present size, and having only one extraction site.

The total amount conserved will be about 1,400 cubic yards per year. The superintendent will have the option to exceed the

established limit in the event of an emergency such as a major flood; therefore, the amount conserved could be less.

NPS use of sand, rock, and gravel extracted from NPS-managed land will be limited to the following maintenance purposes:

- routine maintenance and repairs to structures, facilities, grounds, and trails
- maintenance and repair of existing sanitary facilities
- replacement in kind of minor structures and facilities with little or no change in location, capacity, or appearance
- repair, resurfacing, installation of traffic control devices; or repair/replacement of guardrails, etc., on existing roads
- minor trail relocation, development of compatible trails on existing roads or other established routes, and trail maintenance and repair
- landscaping and landscape maintenance in previously disturbed or developed areas
- rehabilitation in previously disturbed or developed areas, as required to meet health or safety regulations or to meet requirements for making facilities accessible to visitors with disabilities

The following reasons are given to justify limitations on use of sand, rock, and gravel.

- Sand, rock, and gravel can still be barged into the valley.
- Paving of the Stehekin Valley road between Harlequin Bridge and 8-mile will reduce use.
- Erosion control at 8-mile and along the Company Creek road will reduce use.

Reduction of Needs

The upper portion of Company Creek Road is actively being eroded by the Stehekin River, and the existing erosion control structures have been irreparably damaged. *The General Management Plan* calls for the Company Creek road to be repaired and maintained in its current alignment. Three erosion control systems at two locations along upper Company Creek road will be removed and replaced. The structure will be designed to keep the road from eroding during frequently recurring flood events. On the basis of the total amount needed to repair erosion damage since 1968, it is estimated that 320 cubic yards per year will be conserved. Although the new structure will be designed to withstand most erosional forces of the river, a major flood event could damage the new structure. Therefore, the amount conserved could be less than estimated.

Recent lateral migration of the Stehekin River channel toward the Stehekin Valley road resulted in a complete washout near 8-mile during the 1990 flood. The *General Management Plan* called for this section to be repaired and maintained in its current alignment with the use of a new erosion control system. That system was constructed in 1994. The repair of this section required about 1,300 cubic yards of material. Since river erosion has been a problem only recently, an unknown amount of material will be conserved by installing a new erosion control system. Additional material will be needed to repair this section if there should be a major flood event.

The *General Management Plan* also calls for closing unnecessary roads. Most roads that

receive little use should be considered for closure. They typically are not maintained by the park, so very little material would be saved.

The road between 9-mile and Cottonwood Camp will be maintained as a single-lane gravel surfaced road. About the same amount of maintenance will be expected for this section of road, but because the road will be narrower, a small unknown amount of material will be conserved.

Improvement and Maintenance

Between Harlequin Bridge and 9-mile (5.15 miles), the road width will be reduced to a single-lane 12–14 feet wide, with pullouts on each side visible from both directions (18 feet wide; 30–35 feet long) and paved. Because this will be new construction, approximately 3,000 cubic yards of crushed gravel for the surfacing chips and subgrade material will need to be imported. It is estimated that 108 cubic yards per year (5.15 miles x 21 cubic yards per mile per year) will be conserved because of reduced needs for maintenance of the gravel surface.

Roads will be inspected for site-specific drainage problems, and any such problems found will be corrected. Possible remedial actions that will not require major road construction are the installation of culverts, water interceptor systems, and water bars. Some temporary water bars are constructed on the upper valley road each fall to reduce damage from spring erosion. Erosion damage to the upper roads is usually repaired by regrading the existing roadbed material and adding only small amounts of material from the Company Creek Pit. Correcting road drainage problems will conserve an unknown amount of sand, rock, and gravel.

Park maintenance personnel will keep accurate records of how much material from the Company Creek pit is used for maintenance projects. Material use data will be recorded on a standard form to be developed by park personnel. The records should include the type of project, the amount of material used, the project location, the date, and observations. These records will help in identification of problem areas and possibly in development of new conservation measures.

Company Creek Gravel Pit Mining Plan

SITE DESCRIPTION

The Company Creek gravel pit is located in the Stehekin Valley. This valley is the primary physiographic feature in Lake Chelan National Recreation Area, which is part of the North Cascades National Park Service Complex (see the Company Creek Pit Location and Old Borrow Sites map). Lake Chelan National Recreation Area is located in the North Cascades physiographic province. Mountains with elevations of more than 8,000 feet in the national recreation area are carved out of resistant Skagit Gneiss bedrock.

Access to the gravel pit is available via a well-constructed gravel-surfaced road that was constructed in 1981. The road turns off the Company Creek road and passes to the north and west of the Stehekin emergency airstrip. The site is not visible from any road in the valley or from the river. At present, the top edge of the pit is barely visible from the Rainbow Loop Trail.

The Company Creek gravel pit is excavated into a glacial outwash fan at the junction of Company Creek with the Stehekin Valley. This landform is not part of the active alluvial fan of Company Creek; rather, it is a relict feature dating to the last ice age approximately 13,000 years before present. The fan is composed primarily of sand and gravel (see appendix A). Subrounded cobbles and boulders as large as 78 inches in diameter comprise about 30% of the volume of the outwash fan.

The soil formed on the fan surface is classified as the Wapal Series by the Soil Conservation Service (SCS 1991). The texture of the Wapal soil is a very cobbly sandy loam. This soil typically forms in granitic glacial outwash deposits, with minor volcanic ash and loess components. The Wapal soil is excessively drained, complicating attempts at revegetation of disturbed sites. The water erosion hazard is slight for this soil.

There is no surface drainage at the site due to the excessively drained nature of the soils. There is also no evidence of high groundwater at the site.

Native vegetation at the Company Creek pit is an upland mesic mixed coniferous forest. Species include a Douglas-fir and ponderosa pine overstory, with an understory of serviceberry and snowberry. Ground vegetation consists of pine grass, Oregon-grape and kinnikinnick. Native early stage successional species in Lake Chelan National Recreation Area are alder and ceanothus.

Nonnative plants have been observed at the site and at the adjacent airstrip. Some species are rush skeletonweed, scotch-broom, mullein, and knapweed. Rush skeletonweed is a Class B noxious weed of particular concern in the area (RCW 1987, ch. 17.19, "Noxious weeds, Control Boards").

The Company Creek pit was opened in 1981 because material was needed to repair major road damage caused by the December 1980 flood. The National Park Service initially removed 25,000 cubic yards of material for road maintenance and flood damage repair. Much of this material was crushed. The total amount of material excavated between 1981 and 1992 is unclear. Park records are incomplete or inconsistent for this period. At least 30,500 cubic yards were excavated during this period.

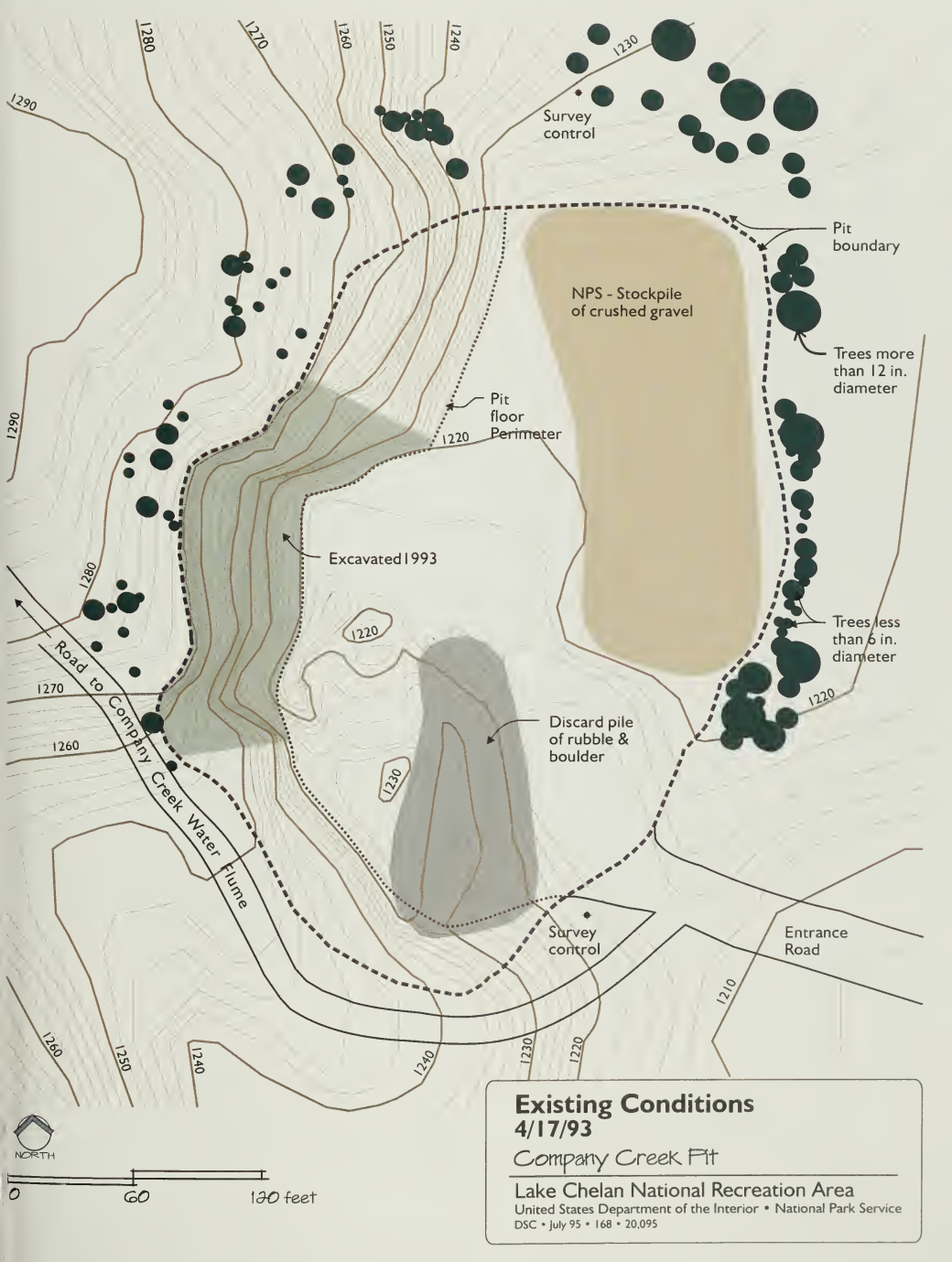
Company Creek Pit

Root mat and organic material (8–10 inches) and underlying alluvial material at Company Creek pit.

Northwest view from the top of the Company Creek pit highwall.

The last major excavation occurred in 1992, when a total of 17,000 cubic yards was excavated and stockpiled. The stockpiles consisted of 12,000 cubic yards of 0.75" and less crushed gravel and a discard pile of approximately 5,000 cubic yards of 8"–10" round rock. The discarded material was too large for the crusher to process.

The existing pit disturbance covers a total of 2.1 acres, with the pit floor covering 1.6 acres of this total. The existing pit high walls have an angle of repose of 1.6:1, or a 70% slope (see map: Existing Conditions, Company Creek Pit, which shows the shape of the pit as of April 17, 1993).



Existing Conditions
4/17/93

Company Creek Pit

Lake Chelan National Recreation Area

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EXTRACTION AND RECLAMATION

The proposed action is to extract enough material to provide approximately 1,400 loose cubic yards (LCY) of usable sand and gravel per year. The plan is designed to cover a 20-year period, during which a total of 28,000 LCY would be extracted (see the "Assumptions," p. 27). The selected area of extraction will be the Company Creek pit. The active area of disturbance at the Company Creek Pit will remain at approximately the same size that it is today. The existing area of disturbance totals 2.1 acres. This includes a pit floor (including work area and stockpiles) 360 feet long by 240 feet wide and an extraction face 50 feet high, creating a horizontal disturbance area 70 feet wide.

The additional area of disturbance over the next 20 years will be approximately 0.8 acre. The National Park Service will reclaim the pit floor and recontour it to conform with the adjacent alluvial fan as the extraction face advances. The final reclaimed pit will trend north-northwest and have a northeasterly aspect to enhance revegetation efforts. This northwest-trending pit wall will mimic the natural, east-facing landform face (35° slope) but with a more gentle slope of 2:1, or 27°. Reclamation efforts will keep pace with advancing extraction so that approximately 2 acres of unreclaimed disturbance will exist at any time. See the 10-Year Mine Plan and 20-Year Mine Plan maps, which show the areas of disturbance and reclamation during the next 20 years. Cross-sectional views are included in appendix B.

The long-term mining plan postulates that (a) if the present mine method and pit configuration remains the same, (b) if the current consumption rate remains the same, and (c) if the sand and gravel deposit remains relatively consistent, the site should provide material for more than 180 years, disturbing a total of 12 acres. The Potential Long-Term Impacts map shows the extent of disturbance over 180 years. Cross-sectional views of the long-term extraction are also included in appendix B.

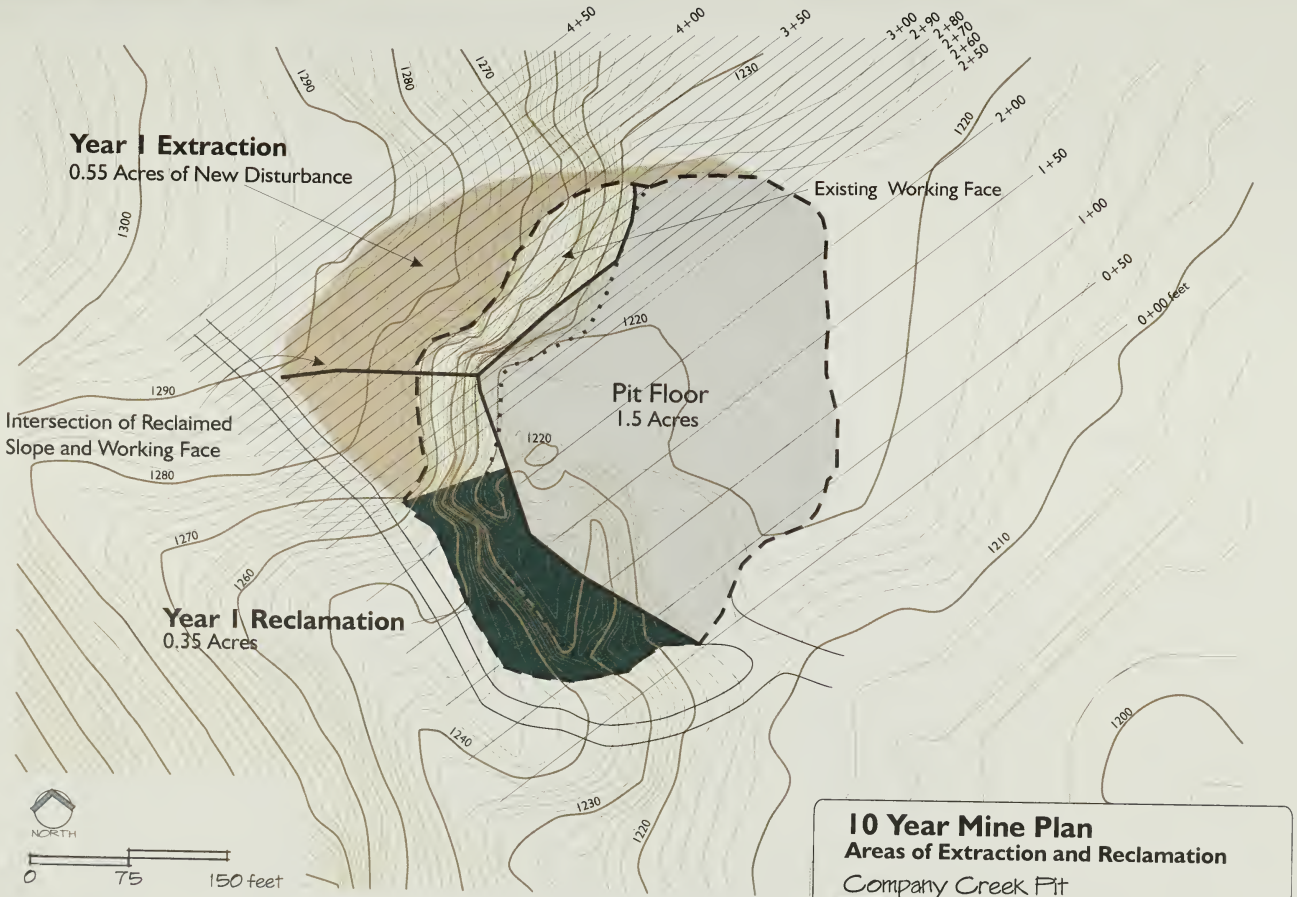
EQUIPMENT AND WORK

The following equipment and work will be necessary.

- one Caterpillar D7U, D8U, or equivalent for extraction, sloping, recontouring, and stockpiling
- one front-end loader for loading of stockpiled material, reclamation contouring, scarification, topsoil removal, transport, and placement
- one truck-mounted crushing and screening plant capable of crushing 10" minus pit-run feed; should be equipped with a stacker capable of stockpiling processed material to a height of 25–30 feet
- Handwork also will be needed, including surveying, site staking, site monitoring, exotic plant control, topsoil spreading, seedbed conditioning/preparation, seeding, transplanting, and irrigating transplants.

METHOD

The method of extraction will be to push material down from the top of the highwall using a Caterpillar D7 or D8 tracked dozer or equivalent. The material will be stockpiled on the pit floor.


Year 1 Extraction
0.55 Acres of New Disturbance
Existing Working Face
Pit Floor
1.5 Acres
Intersection of Reclaimed
Slope and Working Face
Year 1 Reclamation
0.35 Acres
4+50
4+00
3+50
3+00
2+90
2+80
2+70
2+60
2+50
2+00
1+50
1+00
0+50
0+00 feet
1300
1290
1280
1270
1260
1240
1230
1220
1210
1200
NORTH
0
75
150 feet
Existing pit boundary
Existing pit floor boundary
Cross section locations
Note: Contours outside the existing pit were not field examined
10 Year Mine Plan
Areas of Extraction and Reclamation
Company Creek Pit
Lake Chelan National Recreation Area
United States Department of the Interior • National Park Service
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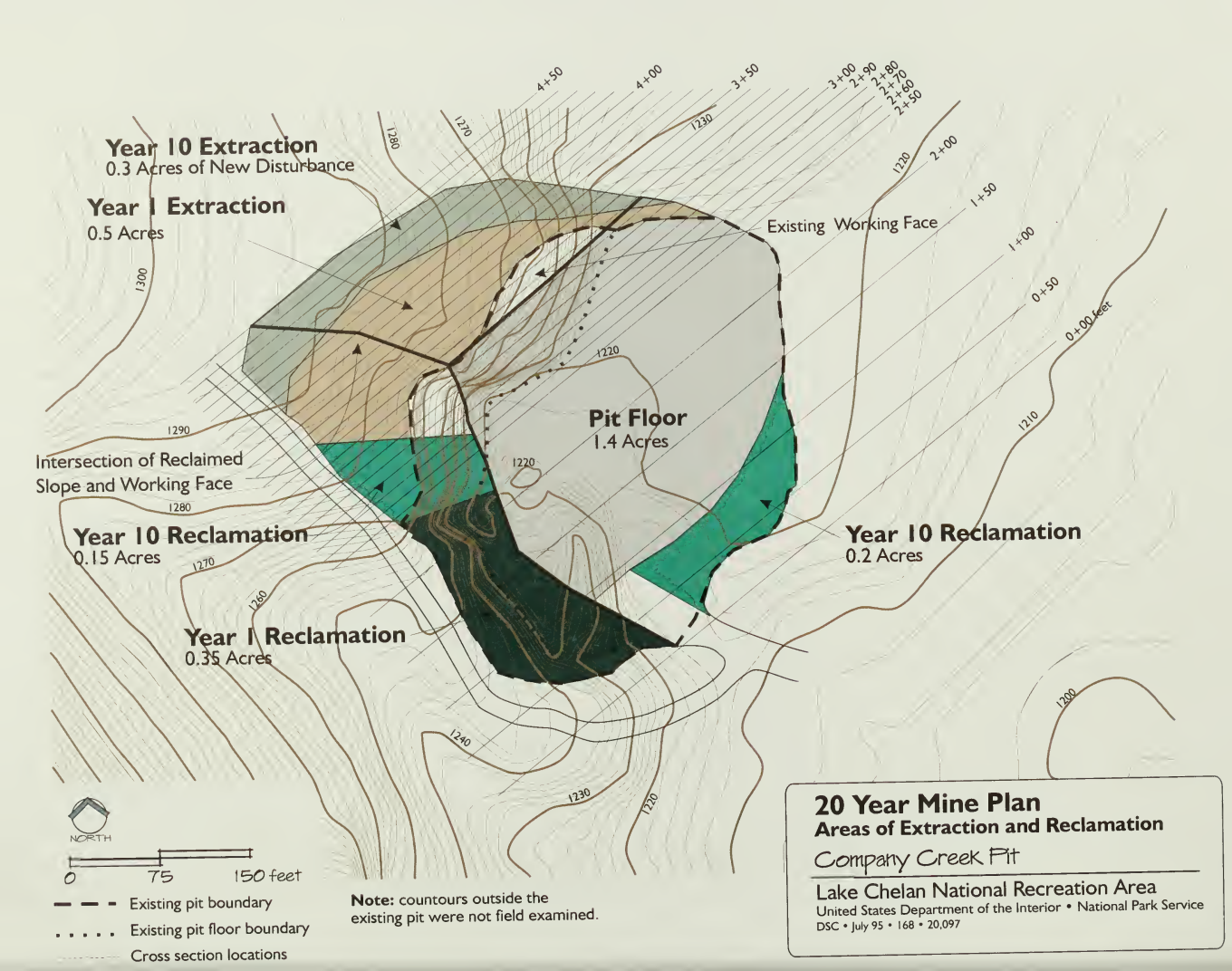
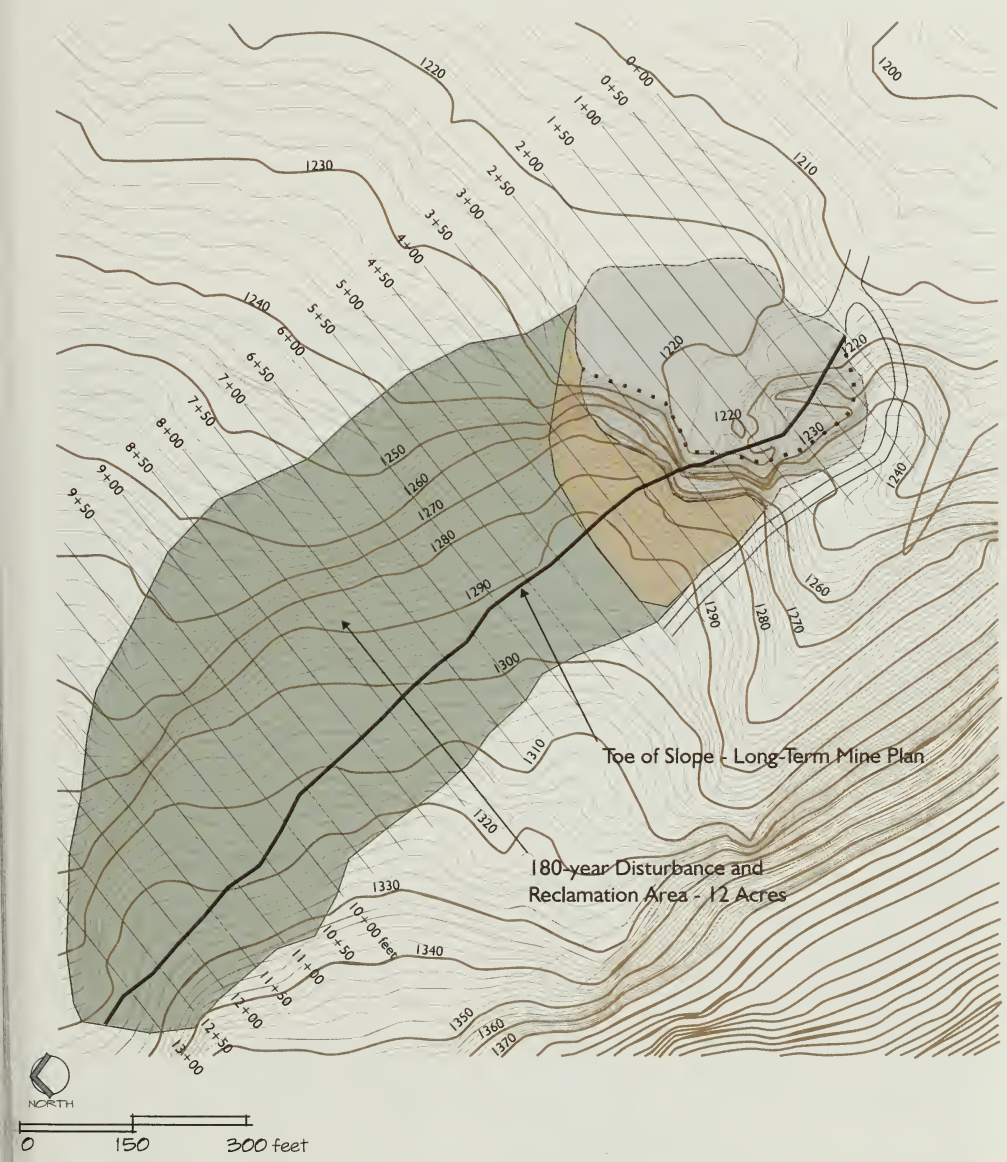

Year 10 Extraction
0.3 Acres of New Disturbance
Year 1 Extraction
0.5 Acres
Existing Working Face
Pit Floor
1.4 Acres
Intersection of Reclaimed
Slope and Working Face
Year 10 Reclamation
0.15 Acres
Year 10 Reclamation
0.2 Acres
Year 1 Reclamation
0.35 Acres
4+50
4+00
3+50
3+00
2+90
2+80
2+70
2+60
2+50
2+00
1+50
1+00
0+50
0+00 feet
1300
1290
1280
1270
1260
1240
1230
1220
1210
1200
NORTH
0
75
150 feet
Existing pit boundary
Existing pit floor boundary
Cross section locations
Note: countours outside the existing pit were not field examined.
20 Year Mine Plan
Areas of Extraction and Reclamation
Company Creek Pit
Lake Chelan National Recreation Area
United States Department of the Interior • National Park Service
DSC • July 95 • 168 • 20,097



Potential Long-Term Impacts

Areas of Extraction and Reclamation

Company Creek Pit

Lake Chelan National Recreation Area

United States Department of the Interior • National Park Service

DSC • July 95 • 168 • 20,098

Extraction will be done once every 10 years, with enough material stockpiled to meet the estimated demands for the following 10-year period. Half of the material will be screened and crushed; the remaining pit-run material will be stockpiled for fill material and other uses.

Before excavation the National Park Service will remove topsoil from the top and sides of the excavation area. The topsoil will then be stockpiled at the top of the cut slopes or next to the pit floor to be reclaimed.

This extraction method will accomplish the following goals.

- A D7 type dozer can stockpile a 10-year supply of material in two and a half weeks; a D8 type can accomplish the same task in one and a half weeks (also see calculations in appendix C). This would be preferable to continual extraction by a front-end loader over the 10-year period.

- Having the dozer in the pit only once every 10 years will enable park staff to monitor the entire two- or three-week extraction process.

- Eliminating angle-of-repose or vertical extraction faces during and after mining will eliminate the safety hazard to the public and to equipment operators working above or below these slopes.

- Slopes will always be at or less than a 2:1 slope ratio and will need little reclamation contouring, if any.

- Topsoil will be stockpiled only for short periods; this will preserve the viability of the seed bank and soil microbes.

- Contoured slopes can begin revegetating immediately after extraction; for example, at the end of 20 years of extraction, 10% of the current pit (0.4 acre) will have 10-year-old revegetation, and an additional 20% of the pit (0.4 acre) will have 20-year-old revegetation.

- Contouring will be done as mining occurs. This will result in pay-as-you-go reclamation rather than requiring a large reclamation cost at the end of the project.

- The requirement that park staff and private operators remove material only from the stockpile will make it possible for the park staff to more accurately monitor the amount of material leaving the pit.

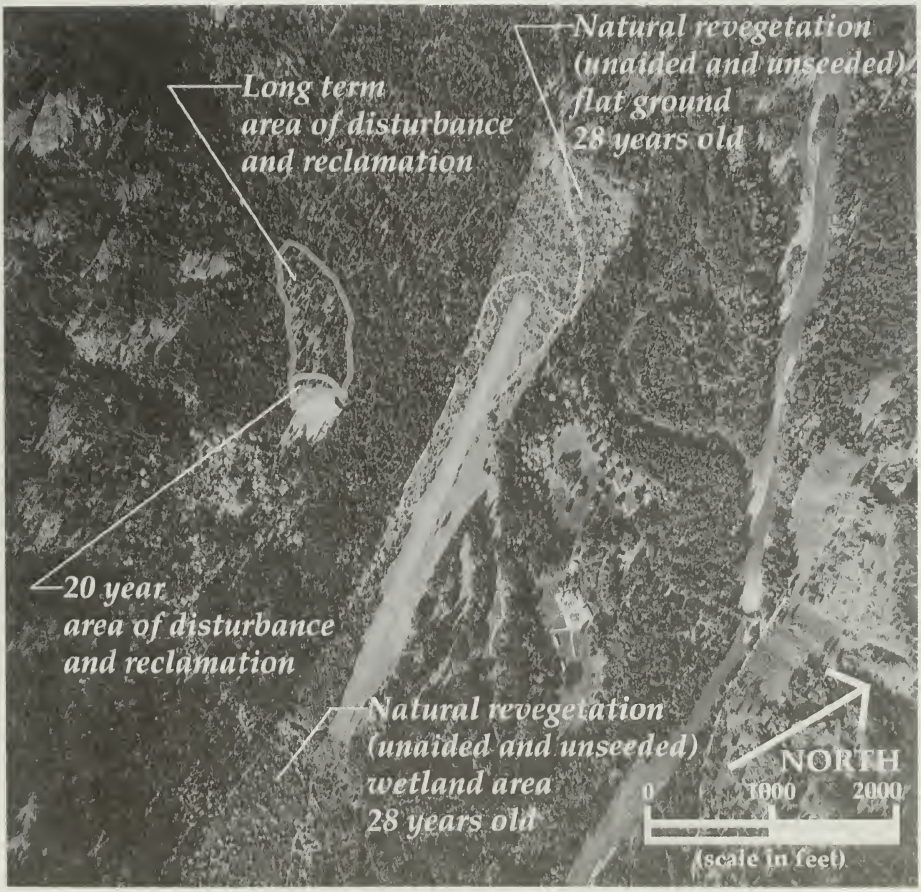
- The requirement that park staff and private operators remove material only from the stockpile also will reduce or eliminate the possibility of material being extracted from the wrong area or in the wrong direction.

PROCESS

The following is a sequential description of each task required in the mining and reclamation process. The 10-Year and 20-Year Mine Plan maps graphically display the mining areas and the areas to be reclaimed during each phase of the operation.

1. *Site Survey:* The park staff will survey the site and prominently stake the following points at the pit:

   Inboard top of cut (ITOC)
   Outboard top of cut (OTOC)
   Outboard bottom of cut (OBOC)
   Maximum extent of pit floor



Aerial view of the Company Creek pit, mine plan boundaries, and natural revegetation of disturbance near the Stehekin airstrip.

Top and bottom of pit slope to be reclaimed
Extent of pit floor to be reclaimed
All points will be surveyed relative to two permanently marked control points established outside the proposed area of disturbance.

Note: the inboard bottom of the cut will have to be determined by the park staff during the extraction process.

2. *Topsoil Removal:* Topsoil removal should take place between September and October to maximize the seed bank. A backhoe/loader will remove topsoil from the extraction area 8–10 inches deep at the top and sides of the terrace. The area of topsoil removal will be defined by the stakes placed at the inboard top of cut (ITOC), the outboard top of cut (OTOC), and the outboard bottom of cut (OBOC). The topsoil will be stockpiled at the top of the slope to be reclaimed and/or near the pit floor to be reclaimed. Topsoil stockpiles will be a maximum of 4 feet high to preserve soil viability.

3. *Material Extraction:* A caterpillar will push the wedge of material defined by the "cut" stakes down from top of the pit slope. The pushed material will be stockpiled on the pit floor at the base of the cut face. The stockpile should be separated from the cut face so the location that where one ends and the other begins is easily discernible. This will enable the park staff to (a) calculate and monitor the volume of material being extracted, and (b) prevent the development of a new angle-of-repose cut face caused by loader extraction of the in-bank material. Equipment operators must take care during extraction so the pit floor slopes up toward the extraction face and does not dive into the slope.

4. *Screening and Crushing:* A screening and crushing plant could be brought into the pit to process the pit-run material at any time during or after task 3.

5. *Oversized Material and Waste Rock:* Oversized material and waste rock will be placed at the toe of the southwestern pit slope. (Extraction may be needed at the toe of the slope to make room for the oversized material and to shape the 2:1 slope.) The top half of large boulders may protrude above the recontoured ground surface to provide a natural-looking surface.

6. *Shaping the Pit Face:* After step 5, the Caterpillar will slope the southwestern pit face to a 2:1 (horizontal:vertical) slope.

7. *Scarification of Pit Floor:* A loader or grader will scarify the pit floor area that is to be reclaimed.

8. *Final Contouring:* A loader will do final contouring or dressing of slopes.

9. *Machine Spreading of Topsoil:* The loader will spread the topsoil over the prepared reclamation areas.

10. *Hand Spreading of Topsoil:* The topsoil will be spread evenly by hand methods if necessary.

11. *Transplanting:* Transplants will be placed (see "Revegetation Methods and Control of Exotic Plant Species," p. 31).

12. *Seeding:* Seed will be broadcast and the reclaimed area raked (see "Revegetation Methods and Control of Exotic Plant Species," p. 31).

13. *Revegetation of Working Face of Pit:* The working face of the pit will be fertilized and seeded to minimize knapweed infestation (see "Revegetation Methods and Control of Exotic Plant Species"), p. 31.

14. *Protection of Reclaimed Areas:* Reclaimed areas of the pit floor will be fenced or blocked from vehicle and foot traffic.

15. *Site Monitoring:* Site monitoring will take place according to the plan described under "Monitoring Program," p. 39.

ASSUMPTIONS

The assumptions that apply to the extraction and reclamation process are shown in boxes in the next two pages.

Assumptions

The following assumptions apply to the extraction and reclamation process.

1. **Extraction Rate:** Estimates for average annual consumption and limited annual consumption are shown below:

Average Annual Consumption

NPS: 2,000 LCY
(600 cubic yards routine maintenance, 1,400 flood (600 pit run + 600 x 1.35 crushed))
Private: 200 LCY
Total: 2,200 LCY
Total BCY per Year: 2,200 cubic yards / 0.7 (30% waste) x 1.15 (15% swell) = 2,735 BCY

5-year extraction: 13,650 BCY
10-year extraction: 27,350 BCY
(11,000 cubic yards pit run; 11,000 cubic yards crushed; 8,205 cubic yards waste)
15-year extraction: 40,950 BCY
20-year extraction: 54,600 BCY
50-year extraction: 136,500 BCY
100-year extraction: 273,000 BCY

SOURCE: Tom Belcher, Facility Manager, North Cascades National Park Complex; other data from discussion with park staff.

Limited Annual Consumption

NPS: 1,200 LCY
(600 pit run + 600 (400 crushed + 200 waste))
Private: 200 LCY
Total: 1,400 LCY
(700 cubic yards pit run, 700 cubic yards crushed)
Total BCY: 1,400 cubic yards / 0.7 (30% waste) x 1.15 (15% swell) = 1,740 BCY

5-year extraction: 8,700 BCY
10-year extraction: 17,400 BCY
(7,000 cubic yards pit run; 7,000 cubic yards crushed; 5,220 cubic yards waste)
15-year extraction: 26,100 BCY
20-year extraction: 34,800 BCY
50-year extraction: 87,000 BCY
100-year extraction: 174,000 BCY
180-year extraction 313,200 BCY

SOURCE: Jon Riedel, Geologist, North Cascades National Park Complex.

Assumptions (continued)

2. **Waste/Oversize:** ≥ 10" = 30%. A total of 30% of the extracted material did not make it into the crushed-rock stockpile because it was oversized. Calculations are shown below.

   In 1992 the park excavated 15,000 bank cubic yards (BCY).
   15,000 BCY x 1.15 (15% swell factor) = 17,250 loose cubic yards (LCY).
   17,250 LCY minus 12,000 cubic yards of crushed stockpiled material = 5,250 cubic yards of oversize / 17,250 LCY = 0.30 or 30%.

   SOURCE: Field observations and discussion with park staff.

3. **Swell factor:** 15%.

   SOURCES: *BLM Handbook for Mineral Examiners; Caterpillar Performance Handbook.*

4. **Bank Material Weight:** 3,400 lb / cubic yard.

   SOURCES: *BLM Handbook for Mineral Examiners; Caterpillar Performance Handbook.*

5. **Loose Material Weight:** 2,900 lb / cubic yard.

   SOURCES: *BLM Handbook for Mineral Examiners; Caterpillar Performance Handbook.*

6. **Harlequin Bridge weight capacity:** 25 tons, 50,000 lbs.

   SOURCE: Jon Riedel.

   D7 Cat = 47,700 lbs with U-Blade
   D8 Cat = 92,000 lbs with U-Blade

   SOURCE: *Caterpillar Performance Handbook.*

   The effective weight of the equipment on the bridge may be adjusted by using a multi-axle lowboy trailer, by shipping the blade separately, or possibly by other means.

7. **Pit floor** will remain at approximately its present size: 240 feet by 360 feet.

8. **Topsoil** (root mat) thickness approximately 6"–10". (This assumption is based on observations at the present pit face and has not been tested or verified in the proposed extraction area.)

9. **Glacial terrace material** is consistent throughout its thickness and extent. (This assumption has not been tested or verified.)

Company Creek Gravel Pit Revegetation Plan

GOALS, OBJECTIVES, AND STANDARDS FOR COMPLETION

The long-range goal of revegetation is reestablishment of a mixed conifer forest resembling stands surrounding the project site. Because the potential for knapweed invasion is very high, the plan proposes intensive seeding and planting with site-adapted plants typically found in adjacent native communities. If fast-growing and shade-producing natives can be immediately established on the site, they reduce the resources available for knapweed and eventually shade it out.

Two types of treatment are proposed. Sites that have been prepared for reclamation will be topsoiled, fertilized, seeded, and planted. On the working face of the pit, which will be reopened at regular intervals, a thick temporary cover of native grasses will be established. See "Implementation," below, for further details.

Cover and survival objectives are as follows:

- Ground canopy cover: 80% after one year. Grasses will provide most of this early cover. They will be seeded at three times the normal rate to achieve high cover.

- Ground, shrub, and tree canopy cover: 100% after the third year.

Standards for completion:

- A shrub and forb survival rate lower than 50% of initial planting densities will require replanting (see "Implementation — Full Treatment" section, p. 36). Replanting will continue until 50% establishment is reached.

- The required survival rate for trees is 80%. Replanting will continue until 80% establishment is attained.

If desired plant densities are not achieved after five years, then plant establishment objectives, standards, and methods should be reexamined.

PLANT MATERIALS

All plant materials will be from genetic stocks indigenous to Stehekin. Trees, shrubs, and forbs will be obtained by salvage, by direct transplanting from areas approved by the park, or by propagating container plants from seed or cuttings. Native seed will be produced from seed collected in Stehekin and increased in isolation under strict quality control standards.

Species Selection

Table 1 lists species and their use and adaptation.

Acquisition

The recommended method of acquiring trees, shrubs, and forbs will be an "indefinite quantities" contract with a native grower or an interagency agreement with the U.S. National Resources Conservation Service (NRCS), formerly the Soil Conservation Service, U.S. Department of Agriculture.

Cone containers cost between 80 cents and $1.50 per plant. Gallon containers cost approximately $2.50–$3.00. Year-old tree seedlings are even less expensive. At present there are several excellent native

TABLE 1: RECOMMENDED PLANTS FOR REVEGETATION AND THEIR USE AND ADAPTATIONS

Species	Common Name	Treatment	Preferred Habitat	Propagation Method	Comments
Grasses					
Agropyron spicatum	Bluebunch wheatgrass	Full treatment and pit face	Sun, dry site	Seed increase	
Elymus glaucus	Blue wild-rye	Full treatment and pit face	Widely tolerant; sun or part shade.	Seed increase	
Forbs					
Antennaria parvifolia	Pussytoes (?)	Full treatment and pit face	Sun, dry site	Local collection of seed	
Shrubs					
Ceanothus velutinus	buckbrush	Full treatment	Sun, dry site	Container plants from seed	
Holodiscus discolor	oceanspray	Full treatment	Sun, dry site	Local collection of seed and container plants from seed	Species produces a *very* high percentage of nonviable seed; container plants may be best method.
Rubus spectabilis	Salmonberry	Full treatment where moist sites, shade or better soils	Wet-medium sites, shade	Container plants from seed or cuttings	Would be suitable in long term as pit reaches shady, moist areas.
Arctostaphylos nevadensis	pinemat manzanita	Full treatment	Sun, dry site	Container plants from seed or cuttings, layering, salvage	Difficult to propagate and slow-growing; some success at Crater Lake with transplanting large mats of it.
Arctostaphylos uva-ursi	kinnikinnick	Full treatment	Sun, dry site	Container plants from seed or cuttings, layering, salvage	Slow-growing
Berberis nervosa	Low Oregon grape	Full treatment	Part shade, dry site	Salvage or transplant small plants; propagate from seed or cuttings.	Seed production good only once every two or three years.
Trees					
Pinus ponderosa	Ponderosa pine	Full treatment	Sun, dry site	Cones or container plants from seed	
Psudotsuga menzieseii	Douglas-fir	Full treatment	Sun, dry site	Cones or container plants from seed	
Acer macrophyllum	Big leaf maple	Later phase	Shade, wet-medium sites	Cones or container plants from seed	Species would be suitable in the long term as pit reaches shady, moist areas.

plant nurseries in the Pacific Northwest with the ability to propagate native plants, even those like pinemat manzanita, which can be relatively difficult. For shrubs and forbs, NRCS prices are comparable with the private sector. Some private nurseries have research skills comparable to those of the NRCS plant materials centers; others do not. Propagation techniques developed by private growers are proprietary information; NRCS developments are public information.

Salvage or direct transplant from approved natural areas is a good supplement to a propagation contract, but it should not be the major source of plants because it is frequently impossible to find sufficient quantities of target species in transplantable sizes.

In-house propagation should be undertaken with caution. The skill levels, time commitment, and staffing requirements of running a propagation facility are often underestimated. The costs of maintaining a facility through the winter are also high.

A small holding facility with water, potting benches, shade, and storage can be useful for handling salvaged plants, receiving and caring for plant deliveries, cleaning seed, and even some preparation of cuttings. Such a facility could be operated by temporary employees in warm months and closed in winter.

EQUIPMENT

Seed Drills

Seed drills insert seed into the ground at the desired depth. Because seed is immediately covered, there may be an advantage in using this type of drill in areas like Stehekin, where preventing wildlife from eating the seed is an important consideration. Most drills cannot be used on slopes steeper than 3:1. A standard rangeland drill is 13–14 feet wide and seeds a 10-foot swath. Half-sized drills are 8–9 feet wide and seed a 5-foot swath.

If the park plans to purchase a seed drill, something with the following capabilities of rangeland drills should be considered.

- The drill should work in rough, rocky, or brushy areas.
- It should be able to meter fluffy or trashy seed.
- It should have a picker wheel and a seed-box agitator.
- It should have a small-seed hopper.

A standard grain drill or corn drill cannot handle native grass and forb seed.

Broadcast Seeding Equipment

Broadcast seeders scatter seed over the surface of the ground without covering the seed or placing it at a set depth. Because some of the seed becomes lost, gets eaten, or lands in inhospitable sites, broadcast seeding rates are generally twice as high as drill seeding rates. The advantages of broadcast seeders are as follows.

- They work on slopes steeper than 3:1.
- They range in size from hand-held to mechanized.
- Seed does not come up in rows and therefore looks more natural.

Resources

If the park purchases seeding equipment, contacting the following organizations and individuals is recommended. These

sources are in touch with the latest advances in revegetation equipment, particularly smaller equipment that can be used in rough terrain.

Mr. Wendell Hassell, National Resources Conservation Service (on detail to NPS)
National Park Service
Denver Service Center, 303/969-2172

Mr. Mark Stannard
NRCS Pullman Plant Materials Center
Pullman, WA — 509/335-7376

International Erosion Control Association
P.O. Box 4904
Steamboat Springs, CO 80477 — 970/879-8563

Forest Service, U.S. Department of Agriculture
Equipment Development Center
Fort Missoula, Building 1
Missoula, MT 59801

IMPLEMENTATION — PIT FACE TREATMENT

The following procedure should be observed in pit face treatment.

1. Remove gravel in late summer or early fall so that the pit face can be seeded during the planting window. If this cannot be done, provide supplemental irrigation for grass at the rate of 1 inch per week until fall rains begin.

2. Within one week or sooner after removing gravel from the pit face, broadcast fertilizer onto the cut and work into the soil. Immediate treatment of the newly disturbed pit face will help control knapweed. Fertilize with a slow-release turf fertilizer (26–7–14, Teufels WINTURF) or a general purpose turf fertilizer (16–4–6) at the rate of 50 pounds of usable Nitrogen per acre. The 26–7–14 would provide immediate and long-term nutrition but would be more expensive. The 16–4–6 would provide immediate nutrition. These products are carried by Teufel Nursery, Inc., which can be reached at 206/743-4444.

   For the 26–7–14, 192 pounds of fertilizer per acre will be needed. For the 16–4–6, the rate will be 312 pounds of fertilizer per acre (see appendix D for calculations).

3. Broadcast the following seed mix and rake lightly to cover.

   Agropyron spicatum, 30%
   Elymus glaucus, 30%
   Antennaria parvifolia, 30%

   The standard ***drill*** seeding rate is based on the number of pure live seeds (PLS) to be put down per square foot. A good base rate for grasses will be 40 pure live seeds per square foot. For the *Antennaria*, because of the extremely small seed, it will be 60 seeds per square foot. The calculations in appendix D were used to translate this into pounds per acre of PLS, as follows:

   Agropyron spicatum, 3.7 lbs per acre
   Elymus glaucus, 4.8 lbs per acre
   Antennaria parvifolia, 0.1 lb per acre

   Because the slope of the pit face will be too steep for a seed drill, a broadcast method of application will be used. A normal ***broadcast*** rate is twice the rate of drilled seed, as shown below:

   Agropyron spicatum, 3.7 lb/acre x 2 = 7.4
   Elymus glaucus, 4.8 lb/acre x 2 = 9.6
   Antennaria parvifolia, 0.1 lb/acre x 2 = 0.2

   Triple this rate because dense establishment is desired to avert knapweed

invasion. The total amounts should be as follows:

Agropyron spicatum, 7.4 x 3 = 22.2 lbs PLS
Elymus glaucus, 9.6 x 3 = 28.8 lbs PLS
Antennaria parvifolia, 0.2 x 3 = 0.6 lb PLS

Once the purity and germination rates for specific seed lots are known, pounds of pure live seed must be converted to pounds of bulk seed.

Calculate the poundage of bulk seed per acre for each species using the following formula: (pounds of bulk seed = pounds PLS divided by (purity) (germination rate). For example, with a purity of 90% and a germination rate of 90%, the poundage of bulk seed required to achieve 22.2 pounds PLS of *Agropyron spicatum* will be 22.2/(0.90) (0.90) = 27.4 pounds of bulk seed.

4. Cover the pit face with excelsior mat with white netting on one side only. Mat should be applied with the netted side on top. See the detailed specification below.

   The erosion control mat shall be a machine-produced mat of 100% aspen wood. Eighty percent of the wood fibers must be more than 6 inches long. The wood fiber must have a consistent thickness and be evenly distributed over the entire area of the blanket. The top side of the blanket must be covered with a white photo-degradable extruded plastic mesh. The opening in the mesh shall be approximately 0.75 inch by 0.75 inch. Mesh with 3/8-inch openings is not acceptable. The blanket must be smolder-resistant without the use of chemical additives. An acceptable product is Curlex by American Excelsior Company (310/949-2461).

   When the blanket is unrolled, the netting should be on top and fibers in contact with the soil over the entire area. In ditches, apply blankets in the direction the water flows, butting them at the ends and sides, and then staple. On slopes, apply vertically to the slope, butting them at the ends and sides, then staple.

   Use wire staples 0.091 inches in diameter or greater, "U" shaped, with 6-inch length and 1-inch crown. Drive staples vertically into the ground.

   On non-ditch areas, staples shall be placed not more than 4 feet apart. For ditch liner, staple along the length of the roll at 4-foot intervals. Staples in all areas shall be 6 inches apart across the width of the ends of each strip. Another row of staples in the center of each blanket should be alternately spaced between the sides for either slope or ditch. Use a common row of staples on adjoining blankets. Any deviation in placement must be approved by the contracting officer.

   This product was selected for the following reasons:

   - It is less likely to attract geese and other birds than straw mulch or straw blanket.
   - The large-sized mesh is less hazardous to small birds and animals.
   - The white mesh degrades quickly in intense sunlight. In 6 weeks to 2 months at Sequoia National Park, this netting showed significant deterioration, while green netting placed at the same location did not. The rate of deterioration at Stehekin will be probably be slower than at Sequoia.

IMPLEMENTATION — FULL TREATMENT

The following procedure should be observed in full treatment.

1. After grading and topsoiling the re-vegetation area as directed above, broadcast fertilizer and work into the soil. Use the same fertilizer analysis and rate as specified above.

2. Using a seed drill that can handle native grass seed, apply the same seed mix as was specified for the pit. To obtain the seeding rate take the ***drill seeding*** rates obtained from the worksheet and multiply 3 for the desired increased in density needed to avert knapweed invasion.

   Agropyron spicatum, 3.7 lbs per acre x 3 = 11.1 lbs PLS per acre
   Elymus glaucus, 4.8 lbs per acre x 3 = 14.4 lbs PLS per acre
   Antennaria parvifolia, 0.1 lb per acre x 3 = 0.3 lb PLS per acre

   Once the purity and germination rates of seed lots are known, adjust the PLS rates to bulk rates using the formula (pounds of bulk seed = pounds PLS divided by (purity) (germination rate). See the example above.

3. Apply erosion control mat as specified above.

4. Because a standard-sized or even a half-sized seed drill would have difficulty in maneuvering around shrubs spaced randomly or in natural groupings, planting follows seeding. If a small maneuverable drill or hand broadcasting is used, it would be acceptable to plant first. Container plants should be installed as outlined below, with care being taken to minimize disturbance of the newly seeded areas. Initial planting densities per 1,000 square feet will be about 16 for small container (cone) trees and 10 for large container trees. For shrubs, 200 per 1,000 square feet and for forts, 333 per 1,000 square feet

   a. Cut through the erosion control mat and excavate planting holes at least twice the size of plant pots.
   b. If the soil is dry, water the holes.
   c. Do not allow the soil to dry out before planting.
   d. Carefully remove plants from containers, keeping roots and soil intact.
   e. Carefully set the plant at the proper level and tamp the soil firmly around the root ball.
   f. Construct a 2-foot saucer around each seedling and mulch with composted wood chips.
   g. Apply water at low pressure to avoid injury to roots.
   h. Thoroughly saturate the plant root zone the same day as planting.
   i. Plants are to be vertical when planted and fully settled.
   j. Place Agriform tablets (18–8–3 forest tablets) 6–8 inches deep around the drip line of the plants. Use as directed on the package or use 1 tablet for each 1/2 inch of tree trunk diameter or for each 1 foot of height or spread of shrubs. This product is carried by Teufel Nursery, Inc., 206/743-4444.
   k. Install identification stakes as directed by the monitoring program.
   l. Cage plants with vexar tubes or construct closed-top cages from hardware cloth to protect from browsing.
   m. Check plants twice a week and water as needed to keep root zones moist. Watering should continue until the onset of fall precipitation or the onset of fall dormancy.

Company Creek Pit Monitoring Program

MONITORING PROGRAM

The purpose of this mine monitoring program is to assess the mining plan and mitigation of environmental impacts. The goals of the reclamation treatments discussed above and this mine monitoring program are as follows:

- to comply with environmental regulations and NPS policies
- to minimize erosion potential within rehabilitated areas
- to prevent impacts on sensitive species, archeological resources, and water quality
- to preserve existing habitat values and processes outside the project boundaries
- to restore and revegetate the area to blend with adjacent habitats
- to retain the visual aesthetics of the area to the extent possible
- to maintain pit size at approximately 2.1 acres or less

This monitoring program will be implemented to evaluate the success of the reclamation treatments over time and will identify problems that require remedial measures or modifications to the mining plan. Monitoring will involve field measurements and inspections. The methods and frequency of inspections are described below. This program will also be used to evaluate and improve reclamation methods. It is recommended that park personnel regularly evaluate and modify this monitoring program as needed to achieve management objectives.

PRE-MINING MONITORING

The project area will be monitored before the extraction and crushing phase, which will occur about every 10 years.

Archeological Resources

The park archeologist will be consulted to ensure protection of archeological resources. No archeological resources are currently known to be in the project area.

Sensitive Species

Park biologists will be consulted to conduct appropriate surveys and develop mitigation to ensure protection of endangered, threatened, or sensitive species that may be in or near the project site. No sensitive habitats used by endangered or threatened species are known to be in the project area. However, some endangered or threatened species may be found in or near the project area. One sensitive plant species (Victoria's grape-fern) is known to be in the project area about 0.33 mile from the existing pit site.

Water Resources

The park aquatic ecologist will be consulted to ensure protection of aquatic resources. Very little hydrologic monitoring should be necessary because the potential for water pollution is low. The site and surrounding area is elevated, dry, and well drained with a deep groundwater table. Water erosion at the site is not evident. The underlying alluvial material has very little influence on

chemical composition of water. Water will be diverted from Company Creek to irrigate reclaimed sites only if the National Park Service has sufficient water rights for such use.

Although there appears to be sufficient flow in Company Creek to maintain dependent life even if some water is diverted to irrigate the reclaimed sites, monitoring flows during low water periods may be worth considering.

Vegetation

The structure and composition of vegetation will be assessed, both in the area to be disturbed and in adjacent areas from which seeds disperse to the disturbed area. The objective will be to establish a baseline community to which the recovery of the reclaimed sites can be compared. This also will help to determine the long-term target vegetation community for the reclaimed areas.

The site will be photographed from set photo points to record site changes over time. The two or three photo sites should be permanently marked and photography conditions recorded so that pictures of the site can be compared. Additional photo sites will be established approximately every 10 years when new mining occurs. Personnel making the photographs should record the type of film, time of day, year, camera settings (f-stop, shutter speed), and camera make and model, and these conditions should be duplicated as nearly as possible each time.

Soils. Soil from the area to be disturbed and used for reclamation and any supplemental soil from other sources should be tested for pH, nitrogen, phosphorous, and potassium levels The objective will be to establish a nutrient level at the reclaimed sites that will support and promote growth of native vegetation. A soil test is optional. The depth and composition of overburden to be removed will be determined to help conserve as much topsoil as possible for reclamation.

MONITORING DURING MINING

The actual mining and crushing operation will be carried out for about one month in the autumn about every 10 years. NPS personnel will monitor the extraction operation on each day of work to ensure the following:

- The depth of topsoil layer removed does not exceed the depth determined during premining monitoring.
- The depth of topsoil stockpiled does not exceed 4 feet (the natural seedbank and microbes will be adversely affected if topsoil is stockpiled at greater depths).
- Soil is stockpiled within designated areas.
- The operator stays within marked bounds. The area should be surveyed and prominently marked with stakes and flagging or fencing so that operators will know the work area boundaries.
- The contour of reclaimed slopes conforms to natural topography or conforms with the slope configurations of the mine/reclamation plan.
- The depth of soil placed on reclaimed areas is not less than 2 inches.
- Any accidental fuel or oil spills at the work site are mitigated according to the *Oil/Hazardous Substance Spill Plan* for the North Cascades National Park Service complex.

- Any work that was completed by a contractor has been assessed to determine whether the operator has fulfilled contract obligations.

POST-MINING MONITORING, REMEDIAL ACTIONS, AND MAINTENANCE

The objectives of post-mining monitoring are to determine if the mining and reclamation goals are achieved, to measure the effectiveness of reclamation efforts, and to improve future reclamation methods used in the project area and throughout the park. If reclamation efforts are unsuccessful in meeting the performance criteria, then remedial action will be considered. When considering the use of remedial measures, monitoring personnel will need to consider the potential benefit of implementing the measures versus the impact (additional site disturbance) of implementing the measure.

Mining Method

The pit-run, oversized, and crushed rock stockpiles will be surveyed every five years to determine the rate of material use. Remedial measures could include increasing or decreasing the amount of material stockpiled or the frequency of mining. The adequacy of the pit slopes and the aspect also will be examined for potential adjustments to future mining operations.

Plant Establishment

Plant establishment will be evaluated by comparing recovery within treated reclaimed areas with unplanted control sites and sites outside the project area. Paired plots (1 meter square or other sizes/shapes) with one plot unplanted will be placed at random in the reclamation area. The appropriate size and shape of each sample plot will be determined during the initial sampling. At least two pairs will be placed on each revegetation site and one pair (planted and unplanted) on the working face. The plot locations will be permanently marked on the ground.

Once a year, in the autumn, measurements will be taken of percentage of survival, percentage of cover, and percentage of species composition. The amount of knapweed and other noxious weeds will be recorded within plots before removal of these species. Except for seeding and planting, the plots should receive the same treatment (weed control, watering, fertilizer) as the rest of the reclaimed areas. Variations with additional plots will also be considered to further improve reclamation methods. For example, plots could be used to compare light seeding versus heavy or to compare different seed mixes.

To document site changes over time, photographs will be taken at least once a year from set photo points during field inspections (methods of recording photographic conditions are detailed earlier in this document). Field data will be recorded on a standard form developed by park personnel. Information included will be the sampling station, treatment type, plot size, measurements taken at the site, and other notes and observations from the field inspection. Field data sheets, maps, photographs, and a summary of observations and proposed remedial actions (if necessary) will be included in a monitoring report prepared by the park geologist or reclamation coordinator.

Soil Erosion

The reclaimed area will be surveyed for evidence of soil erosion caused by wind or water damage at the same time as plant

monitoring. If evidence (such as rilling) is found, remedial measures will be considered. Remedial measures could include installation of water and silt control structures, reseeding and/or replanting area, and reshaping or regrading the area.

Disturbance of Vegetation by Animal or Human Intrusion

Monitoring personnel will keep notes on evidence of herbivory disturbance or disturbance of vegetation by human intrusion or unauthorized extraction. The likely source of the disturbance and the degree of threat to the project will be evaluated. If remedial measures are deemed necessary, they could include fencing the affected plants or area to prevent large mammals and vehicle access, placement of barriers such as large rocks to deter vehicle access, fencing selected plants with animal exclusionary fences, or replanting.

Unsuccessful Rehabilitation Efforts

Over the life of the monitoring program, monitoring personnel will determine if site rehabilitation is occurring according to the performance standards previously set forth. If the desired results are not being produced, remedial measures could include additional site disturbance to relieve compacted soils, additional mulch to provide nutrients and stabilize soils, additional seeding and transplanting, additional irrigation, and soil supplements.

Invasion of Intrusive Nonnative Plants

Monitoring personnel will inspect the site for knapweed and other noxious weeds once a month from April through August or September. Remedial measures could include hand pulling, chemical spot spraying of weeds where appropriate, and reseeding or planting.

Contractors' Obligations

If any reclamation work is completed or plant material is provided by a contractor, monitoring personnel will assess whether the contractor has fulfilled contract obligations.

Mineral Appraisal and Cost Comparison

PRICE DETERMINATION

The purpose of an economic determination is to establish a fair market value or selling price. An economic study was prepared for the National Park Service by Philip Cloues, mining engineer, to determine prices of sand, rock, and gravel to private users in the Stehekin Valley from the Company Creek pit deposit, Lake Chelan National Recreation Area. The study (appendix E) documents the facts, the assumptions, and the reasoning to establish a defendable selling price to local residents of sand, rock, and gravel from the park pit based on economic and market considerations. The study analyzed the cost of various mineral material products available in the vicinity of Chelan, Washington. These costs were then modified to compensate for the high transportation costs associated with limited access to the Stehekin Valley.

Like any supplier in the marketplace, the park management is in a position to take advantage of the transportation cost differential in establishing a fair market value. If park management wanted to offer an incentive to use park resources, the choice would be to establish a low price by not including barge or ground transportation costs. If the park management wanted to discourage park use, it would choose a price equal to the delivered competitive source, which would establish a fair market value equal to the marketplace. Since local use is small, a compromise to split the difference in transportation cost with the purchaser plus the cost of extraction to the National Park Service has been chosen (see table 2 and appendix E)

Prices for sand, rock, and gravel will be reviewed annually to adjust for inflation and changes in transportation costs. The initial prices for sand, rock, and gravel and computation for prices are as follows:

Pit run	$26 per cubic yard
Processed material	$36 per cubic yard
Large rock (>10")	$26 per cubic yard

Computations for Material Prices

Formula

Price/cy = cost/cy for NPS material[1] + 1/2(cost/cy for ground transportation[2] + average cost/cy for barge transportation[2])

Pit-run or large rock

Price/cy = $9.81 + 1/2($5.00 + $26.00) = $26[3]/cy

Processed material (crushed gravel)

Price/cy = $20.00 + 1/2($5.00 + $26.00) = $36[3]/cy

[1] from table 2

[2] from appendix E, $5.00/cy for ground transportation was also used for large round rocks >10 inches

[3] prices were rounded up to the nearest

The initial prices for NPS material are equal to or less than competitive market prices which include transportation costs (see appendix E).

The historic record of use and the stability of the community (a high growth rate does not appear to be a concern) suggest that demand is inelastic; demand is a function not of price, but of growth. It is unlikely that this stable community will suddenly start using significantly more or less mineral materials if the price falls or rises.

COST ANALYSIS OF EXTERNAL VERSUS INTERNAL NPS EXTRACTION

Table 2 shows the estimated costs for producing 28,000 cubic yards of usable

material from the Company Creek Pit during a 20-year period (10-year and 20-year mining plans). A detailed breakdown of these costs is included in appendix F. Estimates were based on 1995 dollar values; they should be reevaluated on a regular basis to adjust for inflation and unknown factors.

The Federal Highway Administration has provided some funds to the national recreation area for reclamation work at the Company Creek Pit as part of the Stehekin Road resurfacing project, which was completed in 1994. These funds will help offset the cost of reclamation; however, they were not included in the cost analysis. The sale of sand, rock, and gravel to local residents will also partially offset these costs.

The total cost for implementing this plan will be about $417,000. The total cost to purchase and transport the same amount of material from sources outside Lake Chelan NRA would be about $980,000, or $563,000 more than under this plan. Administrative costs were not included in the cost estimates for imported material.

Table 3 compares the cost of material per cubic yard from Company Creek Pit to the cost of material from sources outside the national recreation area. Price estimates for material from sources outside the national recreation area are included in appendix E. Comparisons of costs for alternative sand, rock, and gravel plans described in the *General Management Plan* are included in appendix G.

TABLE 2: ESTIMATED GRAVEL PRODUCTION COSTS OF OPERATING COMPANY CREEK PIT FOR A 20-YEAR PERIOD BY NATIONAL PARK SERVICE

Activity	Cost[a]	Cost per Cubic Yard
Mining		
Planning (includes NEPA compliance)	$40,000	$1.43
Site survey and other planning	7,000	0.25
Extraction	22,120	0.79
Reclamation (includes weed control)	157,750	5.63
Monitoring	17,875	0.64
Remediation	30,000	1.07
Total cost for pit-run material	$274,745	**$9.81**[b]
Additional Processing		
Crush 14,000 cubic yards	$142,625	$10.19
Total cost per cubic yard of crushed material		**$20.00**[c]
Grand total	**$417,370**	

a. Costs are a summary of the combined 10- and 20-year mine plan estimates detailed in appendix F.
b. Cost per cubic yard of pit-run material = total cost / 28,000 cubic yards.
c. Cost per cubic yard of crushed material = $142,625 / 14,000 cubic yards + cost per cubic yard of pit-run material.

TABLE 3: COST COMPARISON OF INTERNAL VERSUS EXTERNAL SOURCES OF MATERIAL

	Pit Run	Processed Material
Cost per Cubic Yard		
Outside source (transportation added)	$34.00	$36.00
Source within the national recreation area	9.81	20.00
Price Difference	**$24.19**	**$16.00**

Permitting Process and Operating Standards

SPECIAL USE PERMIT

Private residents of the Stehekin Valley who want to remove sand, rock, or gravel from the Company Creek pit must pay for the material and obtain a special use permit (36 CFR 5 § 5.3, Form 10-114) approved by the district manager before they remove the material. The permit will contain specific constraints and conditions. Permits will be processed on a first-come, first-pay, first-served basis. The district manager will determine permittee eligibility using the standards for application review described below.

No new permits will be issued once the material limits described below are reached. An example of the permit (with stipulations) is shown in the prototype permit, beginning on p. 51.

Permittees will be charged a fee per cubic yard for the removal of sand, rock, and gravel from the Company Creek extraction site. The fee for processed crushed material will be higher than that for unprocessed pit-run material, to cover the costs of crushing and stockpiling. Fees, which must be sufficient to cover application, administration, and monitoring costs, will be recalculated periodically. The fees will be due at the time of permit issuance and will be based on the permittee's estimate of the amount of material to be extracted under the permit. Overpayments will not be refunded.

A total of 2,000 cubic yards of material will be extracted and stockpiled every ten years for private use. An average of 200 cubic yards of sand, rock, and gravel per year will be available for sale from the Company Creek pit site. Up to 100 cubic yards from this average annual amount may be available as crushed material. The annual individual household limit will be 50 cubic yards. If the entire 2,000 cubic yards of material stockpiled for private use is consumed before the next 10-year extraction cycle, then there may be some years when no material will be available.

STANDARDS FOR APPLICATION REVIEW

Stehekin property owners and residents of Stehekin will be eligible to purchase from the National Park Service sand, rock, and gravel from the Company Creek extraction site in Lake Chelan National Recreation Area. Before a permit is issued by the district manager, the permittee must (a) show proof of residency or property ownership and (b) agree to the conditions of the permit.

Special Use Permit

Special Use Permit No. _____ Page 1 of ___

UNITED STATES DEPARTMENT OF THE INTERIOR
National Park Service

Name of Use: SAND, ROCK AND GRAVEL EXTRACTION

Name of Area: COMPANY CREEK PIT, NATIONAL PARK SERVICE

Long Term _____ Short Term X

Permit Reviewed _____, **19**____ (date) **Reviewed** _____, **19**____ (date)

Reviewed _____, **19** ___ (date) **Expires** _____, **19**____. (date)

Name of Permittee: _____ of

Address: _____

Phone: _____ is hereby authorized during the period from (time) _____, the _____ day of (month) _____, 19____ through (time) _____ the _____ day of (month) _____, 19____ to use the following described land or facilities in the area named above.

The Company Creek pit, located 500 feet west of the Stehekin airstrip

for the purpose(s) of extracting material as indicated in the table below:

Material	Amount (cubic yards)	Price Per Cubic Yard	Total Cost
Stockpiled unprocessed sand, rock, and gravel (pit run)		$26	
Stockpiled crushed material		$36	
Stockpiled large rock (>10")		$26	
Total			

Authorizing legislation or other authority (RE-NPS-53 Appendix 1):

The sale of sand, rock, and gravel to local residents is authorized by Section 206 of the Washington Park Wilderness Act of 1988 (P.L. 100-668) that amends section 402(b) of the Lake Chelan NRA enabling legislation (16 USC 90c-16b).

NEPA Compliance:

CATEGORICALLY EXCLUDED ___ EA/FONSI ___ EIS __X__

OTHER APPROVED PLANS __Lake Chelan NRA Sand, Rock, and Gravel Plan__

Performance Bond: Required ___ Not Required __X__ Amount $ _____

Liability Insurance: Required ___ Not Required __X__ Amount $ _____

ISSUANCE of this permit is subject to the conditions on the reverse hereof and appended pages and, when appropriate, to the payment to the U.S. Department of the Interior, National Park Service, of the sum of $ _____.

The undersigned hereby accepts this permit subject to the terms, covenants, obligations, and reservations expressed or implied herein.

Permittee: _____ _____
(signature) (date)

Authorizing Official: _____ _____
(signature and title) (date)

Additional Authorizing Official (if required):

_____ _____
(signature and title) (date)

STANDARD SPECIAL USE PERMIT CONDITIONS

1. The permittee shall exercise this privilege subject to the supervision of the Superintendent, and shall comply with all applicable laws and regulations of the area.

2. **Damages** — The permittee shall pay the United States for any damage resulting from this use which would not reasonably be inherent in the use which the permittee is authorized to make of the land described in this permit.

3. **Benefit** — Neither members of nor delegates to Congress, nor resident commissioners shall be admitted to any share or part of this permit or derive, either directly or indirectly, any pecuniary benefit to arise therefrom. Provided, however, that nothing herein contained shall be construed to extend to any incorporated company, if the permit be for the benefit of such corporation.

4. **Assignment** — This permit may not be transferred or assigned without the consent of the Superintendent, in writing.

5. **Revocation** — This permit may be terminated upon breach of any of the conditions herein or at the discretion of the Superintendent.

6. The permittee is prohibited from giving false information; to do so will be considered a breach of conditions and be grounds for revocation: [Re: 36 CFR 2.32 (4)].

7. Permittee will comply with applicable public health and sanitation standards and codes.

8. The following provisions constitute Condition 4 in accordance with Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967.

   Nondiscrimination. If use of the resource covered by their permit will involve the employment by the permittee of a person or persons, the permittee agrees as follows.

   (a) The Permittee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The permittee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Permittee agrees to post in conspicuous places, available to employees and applicants, employment notices to be provided by the Superintendent setting forth the provisions of this nondiscrimination clause.

   (b) The Permittee will, in all solicitations or advertisements for employees placed by or on behalf of the Permittee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

(c) The Permittee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Superintendent, advising the labor union or workers' representative of the Permittee's commitments under section 202 of Executive Order 11246 of September 24, 1965, as amended, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Permittee will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Permittee will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto and will permit access to his books, records, and accounts by the Superintendent and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Permittee's noncompliance with the non-discrimination clauses of this permit or with any of such rules, regulations, or orders, this permit may be canceled, terminated, or suspended in whole or in part and the Permittee may be declared ineligible for further government contracts or permits in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 25, 1965, as amended, or by rule, regulations, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Permittee will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each subcontract or purchase order as the Superintendent may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, however, that in the event the Permittee becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Superintendent, the Permittee may request the United States to enter into such litigation to protect the interests of the United States.

CONDITIONS OF APPROVAL
FOR COMPANY CREEK PIT MATERIAL EXTRACTION

Violation of the conditions and stipulations of the special use permit could constitute justification for permit termination, damages, penalties, and/or the denial of future applications for material.

A. **Pit Restrictions.** All private extraction activities are limited strictly to within the boundaries of the pit floor. No vehicles or other equipment may be driven or parked on the pit walls or reclamation areas. Monuments and slope stakes are not to be disturbed. No dumping of material will be allowed. Hazardous materials (including, but not limited to, chemicals, fuel, and oil) will not be stored or disposed of in the pit.

B. **Equipment Allowed.** A permittee may extract materials from the site by hand or loader. Storage of equipment or use of specialized equipment such as a crusher or screener is prohibited unless specifically authorized in the permit. The National Park Service will not load or haul any material for permittees.

C. **Material Available at the Pit.** Sand, rock, or gravel may only be removed from stockpiled material at the Company Creek pit. Absolutely no material may be taken from the pit walls or reclamation areas. No NPS stockpiled *crushed* material may be taken without specific permission identified on the permit.

D. **Access to the Pit.** Roadways must be kept clear, and access to other areas of the gravel pit must be maintained at all times. The National Park Service reserves the right to restrict access to the pit during wet periods to protect access roads from vehicle damage. The National Park Service will not maintain access during the winter months.

E. **Possession of Permit.** The permittee must be in possession of the permit while removing sand, rock, and gravel from the pit area and during hauling operations. The permit will be returned after hauling is completed.

F. **Extraction Period.** All sand, rock, and gravel permitted must be removed before the expiration date of the permit. Material may be loaded and hauled only on days and at times as specified on the face of the permit.

G. **Use of Material.** The permittee agrees that the material will be used only for maintenance projects not requiring a building permit. Material will not be used in any manner for new construction projects.

H. **Record of the Amount of Material Extracted.** When removing the sand, rock, and gravel from the pit area, the permittee will list the date, time, and amounts taken during each trip on the permit.

I. **Transfer of Permits.** Permits shall not be transferred or used by others, except contractors or other designee acting on behalf of the permittee. A contractor or other designee acting on behalf of the permittee must carry all permits and adhere to the same terms as the permittee.

J. **Liability.** The permittee and those accompanying him or her shall indemnify and hold the United States, Department of the Interior, National Park Service, harmless from any claims, loss, cost, injury expense, attorney's fees, damages, or liability caused by or arising out of the exercise of this permit.

NATIONAL PARK SERVICE STANDARD STIPULATIONS

NPS OPERATING PROCEDURES

Extract from stockpiled material only.

Emergency extractions can be taken only from the eastern half of the working face (see "Emergency Extraction Criteria").

The mining plan and reclamation methods will be monitored (see "Monitoring Program," p. 39). Changes in mining method, exotic plant control, and reclamation method can then be recommended to the superintendent. Changes must be reviewed for compliance with the EIS and approved by the superintendent before implementation.

The park staff must accurately stake each area of extraction before excavation (with slope stakes) and must monitor equipment activities at all times to ensure compliance with the approved mining plan.

No fuel storage will be allowed at the pit.

Inert or nontoxic materials may be temporarily stored at the pit until their disposal at an approved disposal site as long as storage does not interfere with pit operation or reclamation activities.

Abandoned areas of the pit will be reclaimed during the same year that material is extracted [in order to meet the goal of keeping the pit the same size as it is now].

EMERGENCY EXTRACTION CRITERIA

Emergency extractions must meet all of the following conditions:

A. The material is needed to prevent catastrophic loss of NPS or private property or to prevent an imminent health and safety hazard.

B. There is not sufficient stockpiled material to meet the emergency need.

C. Material cannot be obtained from another source in time to prevent property loss or health and safety hazards as described in "A."

D. Extraction activities will proceed within the disturbance area defined in the Long-Term Mine Plan map.

E. Extraction activities must be monitored by an NPS resource specialist to ensure compliance with "D."

F. The emergency extraction must be approved in writing by the superintendent.

Rainbow Creek Gravel Pit Reclamation Plan

RAINBOW CREEK GRAVEL PIT

The Rainbow Creek Gravel Pit is the only extraction site within the boundaries of Lake Chelan National Recreation Area that will be subject to active reclamation. Most of the other pits will not be actively reclaimed because they are in the advanced stages of natural recovery (see "Former Extraction Sites" section, p. 71). The purpose of this plan is to rehabilitate the natural topography and vegetation at the Rainbow Creek gravel pit. Restoring these natural features will mitigate the invasion of nonnative plants, flooding, and other adverse impacts of previous mining operations.

MANAGEMENT OBJECTIVES AND STANDARDS FOR COMPLETION

The management goals and resource concerns for the Rainbow Pit reclamation are to do the following:

- prohibit excavation of material from the pit for any purpose.
- rehabilitate the topography of the pit to mitigate flooding and streambank erosion problems; this will also help stabilize the steep northeast wall of the pit
- permanently remove all nonnative plant species from the pit
- permanently reestablish a viable native vegetation community at the pit

SITE DESCRIPTION

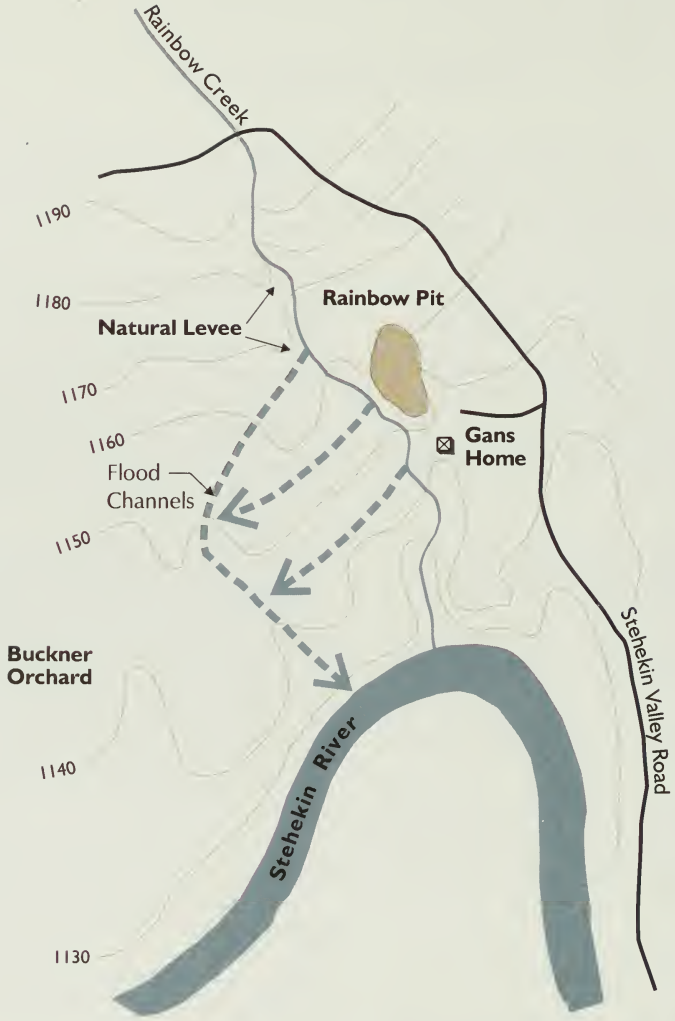
The Rainbow Creek gravel pit is 0.5 mile above the confluence of Rainbow Creek and the Stehekin River, on the south bank of the creek (see Company Creek Pit Location map and Rainbow Pit Topographic map). The pit is bordered on the south by private property: tract 05-104, 2 acres.

Rainbow Creek appears to have occupied this part of its alluvial fan for the last century, if not longer. Between the Stehekin Valley road bridge and the pit, the creek flows in a braided channel. This channel pattern indicates the creek is locally aggrading and that its channel is relatively unstable. Since the 90-year flood of 1948 the creek has incised slightly into deposits left by that flood.

Flood overflow from the creek spills to the northwest into a series of channels that drain initially toward Buckner Orchard but turn southwest and enter the Stehekin River just above Rainbow Creek (Rainbow Pit Topographic map). Another large (>50-year) flood could send the entire creek in this direction, resulting in the abandonment of its present channel. It appears that any upstream avulsion would be to the west, since the east bank of the stream is locally the high side.

There are no private or public water removals for Rainbow Creek downstream from the pit. The Buckner Orchard historic district removes water upstream for irrigation of the orchard. Other possible water quality or quantity issues include potential contamination of water by fertilizing plants in the pit.

The pit is located on the alluvial fan of Rainbow Creek. Natural slopes on this landform are typically less than 5° with local relief less than 5 feet. The soil that has developed in the alluvial fan gravels was classified as a Wapal series soil by the Soil Conservation Service (SCS 1991). The Wapal series is a poorly developed soil in



NORTH

0 6000 12,000 feet

Topographic Map

Rainbow Pit

Lake Chelan National Recreation Area

United States Department of the Interior • National Park Service

DSC • July 95 • 168 • 20,099

a very cobbly sandy loam alluvial gravel. It is excessively drained and has an organic layer less than 1 inch thick.

Past attempts at revegetating the pit have been only modestly successful because of poor soil conditions. The Natural Resources Conservation Service has noted that seedling mortality on the Wapal soil is generally severe, particularly if the organic layer is removed. Seedling mortality can be reduced by shading and irrigation.

Native vegetation at the site varies, depending upon the amount of disturbance and the success of revegetation efforts. In general the tree species in the pit area are Douglas-fir, cottonwood, ponderosa pine, and white pine. Shrubs in the disturbed area include blackberry, flowering currant, and ceanothus. Forbs include bluebunch wheatgrass and blue wild rye. Nonnative species found in the pit area are scotch broom, mullein, and knapweed.

Native trees found in undisturbed areas adjacent to the pit are Douglas-fir, ponderosa pine, and bigleaf maple; shrubs are elderberry, ceanothus, mock orange, ocean spray, serviceberry, and kinnikinnick. Ground cover species found in undisturbed areas around Rainbow pit are pod fern, bracken fern, Oregon grape, yarrow, pearly everlasting, lomatium, pine grass, bluebunch wheatgrass, and blackberry.

OPERATION AND BACKGROUND

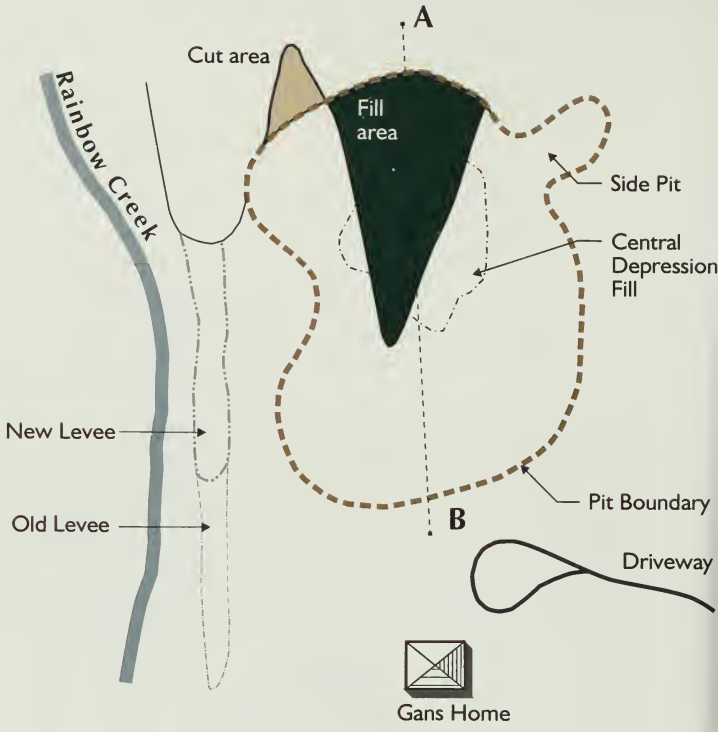
In the mid 1970s the National Park Service authorized opening of the Rainbow Creek gravel pit to provide aggregate material for road construction on the Stehekin Valley road (see Company Creek Pit Location map). Approximately 25,000 cubic yards of material was removed, including the left (south) bank of Rainbow Creek (see map: Rainbow Pit Proposed Topographic Reconstruction).

The existing pit covers approximately 1.5 acres, as shown on the Rainbow Pit Existing Conditions map. The pit has a headwall 18 feet tall and a central depression 4–6 feet lower in elevation than the south end of the pit. Slopes on the steep east and northern walls of the pit are at the angle of repose for sand and gravel (35°). This slope is unstable, limiting the ability of vegetation to colonize successfully.

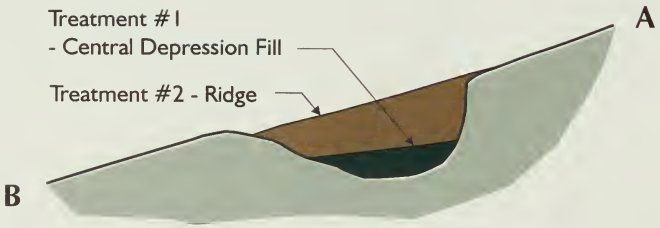
Removal of the streambank has created an opening for floodwater from Rainbow Creek to enter the pit during spring runoff. Floodwater follows the floor of the pit parallel to the creek onto private land before returning to the creek bed. A high spring groundwater table may also contribute to the flooding.

In the 1980s a crude log and gravel erosion control structure was placed along the streambank. This attempt at erosion control was unsuccessful, and the pit continued to flood during periods of high runoff. The original structure was rebuilt in 1993. The logs were removed, and the structure was reinforced with a rock and gravel berm 50 feet long, 6 feet wide and 4 feet tall. The berm was constructed to prevent flooding and erosion of the north edge of the pit. This structure probably is inadequate to keep a large flood (50-year or greater recurrence interval) from entering the pit and causing additional erosion. Further, the top foot or so of the structure is unstable and has no vegetative cover.

Shortly after the pit was abandoned, nonnative plants began invading the disturbed, rocky ground on the pit floor. NPS employees and local residents have spent countless hours attempting to control these species in the past 10 years. Several attempts have been modestly successful in controlling the spread of these plants.



Plan View



Profile

Schematic map - no scale

Rainbow Pit Proposed Topographic Reconstruction

Rainbow Pit

Lake Chelan National Recreation Area

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Existing Conditions

Rainbow Pit

Lake Chelan National Recreation Area

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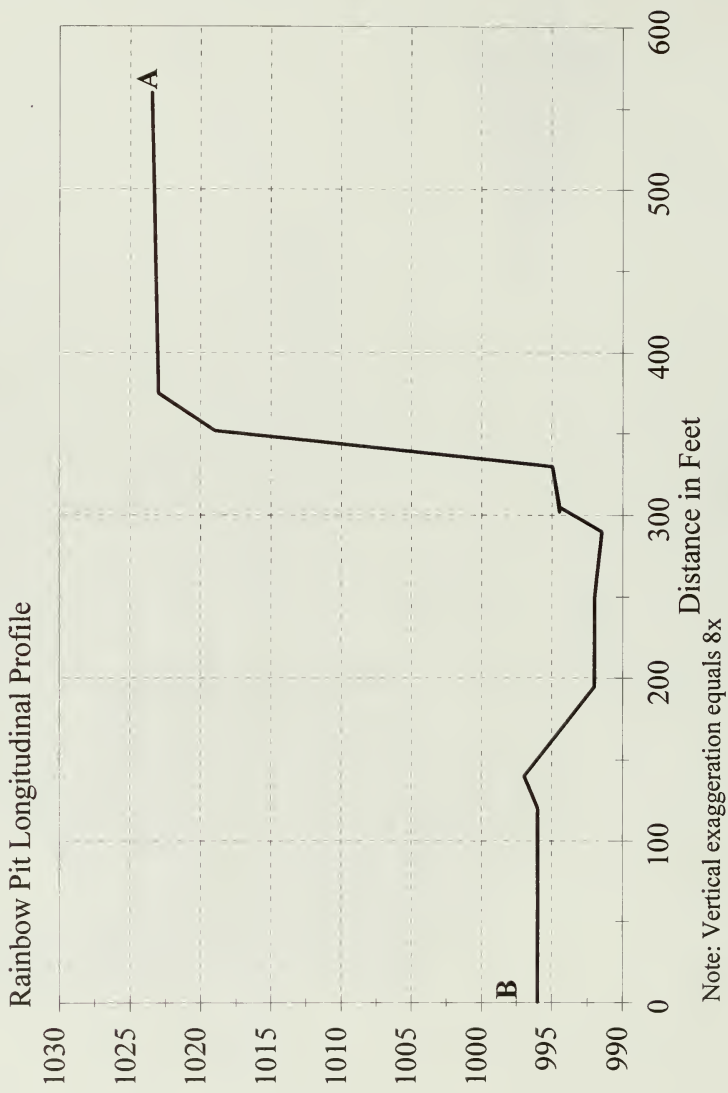

Note: Vertical exaggeration equals 8x
See map on previous page for location of A to B cross-section

Rainbow Pit Longitudinal Profile

Attempts to reestablish native fir and pine at the site through transplantation have had limited success because of poor soil conditions and a lack of shade and moisture. The addition of organic material and irrigation generally have improved the success rate.

RECOMMENDED MANAGEMENT ACTIONS

The following management actions will be designed to mitigate the negative effects caused by operation and abandonment of the Rainbow Creek gravel pit. These actions are presented in the order of application. The timetable for completing this rehabilitation plan is three years, as delineated in table 4. All major rehabilitation actions should be complete by the end of 1997, although certain activities (such as irrigation and control of nonnative plants) will continue until a native vegetation community is well established at the site. Cost estimates for the rehabilitation of the Rainbow Creek gravel pit are included in appendix F.

Because of the nearness of the pit to Rainbow Creek and the frequent flooding of the pit floor, the national recreation area will consult with the U.S. Army Corps of Engineers to ensure that the following actions comply with the Clean Water Act.

The rehabilitation actions briefly indicated in table 4 are described in the following paragraphs.

Action 1: Topographic Restoration

To mitigate the flooding problem, the topography of the pit area will be recontoured. This will be accomplished by filling the lowest part of the pit, regrading the pit headwall, and constructing a topographic feature (levee) in the center of the pit. Partial filling is recommended because it would take approximately 25,000 cubic yards of material to fill in the entire pit, reconstructing the pre-pit landscape. Total filling would be costly and would result in considerable impacts on other areas such as the Company Creek pit site). Partial filling will adequately mitigate the flooding problem and also help mitigate the visual intrusion the pit makes on the adjacent landscape.

Topographic restoration will begin with filling of the deep central part of the pit, which covers slightly more than 1 acre (see map: Rainbow Pit Proposed Topographic Reconstruction). The area will be filled with 4 feet of material (to 96 feet elevation). It is estimated that approximately 1,800 cubic yards of clean fill will be required.

The existing north wall and center of the pit will be shaped to mimic the topography created by natural processes of alluvial fan construction (see Rainbow Pit and Vicinity Map). The continuous, steep north wall of the pit will be broken in two places (see Proposed Topographic Reconstruction of Rainbow Pit map). A gully 4–5 feet deep will be made into the top of the wall at the northeast end of the pit. It will extend 10–15 feet into undisturbed ground at one end, and to the south end of the pit.

An existing gully in the northeast corner of the pit will be retained and slightly modified. Material excavated from the gullies will be used at the base of the steep west and east walls of the pits to reduce the slope of these walls. Reduced slope angles will stabilize these walls and facilitate their colonization by native vegetation.

Between the gullies a levee 200 feet long will be constructed in the center of the pit (see map: Proposed Topographic Reconstruction of Rainbow Pit). The levee will reach from the top of the pit wall (1,012

TABLE 4: RAINBOW PIT: TIMELINE FOR IMPLEMENTATION OF REHABILITATION

1995				1996				1997				1998		
Win	Spr	Sum	Aut	Win	Spr	Sum	Aut	Win	Spr	Sum	Aut	Win	Spr	Sum
	1	3	1			3,4	2,4,5		5	3,6	5			3,6

1995
- Winter
- Spring — 1. topographic restoration (levee)
- Summer — 3. non-native species control
- Autumn — 1. topographic restoration

1996
- Winter
- Spring
- Summer — 3. non-native species control, 4. soil building
- Autumn — 2. surface erosion control, 4. soil building, 5. revegetation

1997
- Winter
- Spring — 5. revegetation
- Summer — 3. non-native species control, 6. plant irrigation
- Autumn — 5. revegetation

1998
- Winter
- Spring
- Summer — 3. non-native species control, 6. plant irrigation

feet elevation) down to the elevation of 996 feet. It is estimated that the levee will require 5,000 cubic yards of material. This feature will help break the continuous north wall of the pit and will mimic the natural topography of an alluvial fan, although it will be slightly larger than natural levees.

All topsoil disturbed will be stockpiled and used for soil conditioning of the surface. Disturbance of existing native vegetation will be kept to a minimum.

The 6,800 yards of clean fill material necessary for this action will come from the redistribution of material on the site (500 cubic yards), from the Boulder Creek Bridge reconstruction (500 cubic yards), and from the Company Creek pit (5,000 cubic yards). About 5,000 cubic yards of material has been left in the Company Creek pit as spoils from the recent crushing contract. About 2,000 cubic yards of this discard material will be used for the Rainbow Pit reclamation. An additional 3,000 cubic yards will be taken after the first 10-year extraction cycle. The stockpile of crushed material at Company Creek Pit exceeds 3,000 cubic yards and will compensate for the additional material needed to reclaim Rainbow Pit.

Based on the capacity of the Harlequin Bridge, it will take about 660 trips (at 6 cubic yards per trip) from the Company Creek pit to the Rainbow pit. Boulders and cobbles will be placed at the bottom of the

infilling, as erosion control, particularly at the edge of the creek. Finer sediment from the Company Creek pit and other sources will be placed on the surface of the new topography.

There are two options for hauling the material into the pit. The entire job could be contracted out, or the National Park Service could haul the material. If the National Park Service was to haul the material, additional dump trucks would need to be brought in to facilitate the movement. The cost estimate for the in-house option is presented in appendix F.

Time: fall 1994 or spring 1995
Material: sand and gravel from on the site and from the Company Creek pit
Equipment: front end loader, dump truck(s) and backhoe
Human Resources: equipment operator (8 weeks), park geologist (2 weeks), engineering technician (2 weeks), and dump truck driver (8 weeks)

Action 2: Surface Erosion Control

The boulder and cobble levee placed in the fall of 1993 will be retained in its present dimensions, with minor modification. The size of material in the levee is more than adequate to keep Rainbow Creek from eroding into the pit. Modification of this structure will include a slight lowering of the top to create a more stable surface for revegetation, slight widening, and placement of fine soil material on the surface to support vegetation growth. It is estimated that the levee will be lowered 1 foot or less. These modifications can be accomplished by hand labor.

Surficial erosion in the pit is not a significant problem, due primarily to the coarse nature of the alluvial fan gravels. Place an excelsior mat or locally collected duff over the topsoil.

Time: annually from 1996 on
Material: erosion control fabric
Equipment: none
Human Resources: one resource technician for 2 weeks

Action 3: Nonnative Species Control

Removal of all exotic species from the pit will be accomplished primarily by hand labor. It will continue indefinitely until all nonnative species have been eradicated from the site. Newly germinating weeds will be aggressively removed from the pit on an annual basis until native vegetation is well established. Chemicals are not recommended for use because of nearby surface water and wells on private property.

Time: annually
Material: none
Equipment: weed-killing blankets
Human Resources: two resource technicians for two weeks per year, indefinitely

Action 4:. Soil Building

Soil will be built on the surface of the reconstructed pit topography to support native vegetation. The soil will need to be treated to make it more suitable for revegetation with native plants. Material from the Company Creek pit will closely match native parent soil material on the site in texture. Since the native soil at the site is a poorly developed Entisol, it will not be necessary to build more than 2–3 inches of new topsoil at the site to replicate native soil fertility.

Making a topsoil suitable for revegetation will be accomplished by a variety of methods. First, the material brought in to the site will be sent to a lab for NPK (nutrient) analysis. Any existing topsoil in

newly disturbed areas will be stockpiled and used. Topsoil will be "manufactured" at the site by combining fine soil particles from the Company Creek pit with peat moss, wood chips, and branches. A wood chipper will be rented to make the wood chips. These materials will greatly enhance the coarse textured soil's water-holding capacity. However, microorganisms that will break down this material will require the addition of a large amount of fertilizer.

The soil will be fertilized with a slow-release turf fertilizer (26-7-14, Teufels WINTURF) at a rate of 50 pounds of usable nitrogen per acre. For the 26-7-14, 192 pounds of fertilizer per acre will be needed. General purpose fertilizer is not recommended because of the potential of fast-release fertilizers to pollute nearby water.

Time: summer or fall 1996
Material: lime, peat, topsoil, fertilizers
Equipment: backhoe, dump truck, wood chipper, various hand tools
Human Resources: backhoe operator for 2 weeks, dump truck driver for 2 weeks, 2-person hand labor crew for 4 weeks

Action 5: Revegetation

The entire pit area will be revegetated with native species. Clusters of native trees and shrubs will be interspersed across the reconstructed pit landscape. This will be accomplished by using transplants from within the pit, while others may come from disturbed sites in the valley. Between the clusters of native trees and shrubs, native grass will be broadcast seeded across the entire area. These seeds will be native stock grown in a commercial area. Additional seeds from other native forbs will be collected and broadcast over the area. Most plant material will be acquired through a contract with native growers or an interagency agreement with the National Resource Conservation Service.

Time: fall 1996, spring 1997
Material: local plant material, commercially produced native grass seed
Equipment: hand tools, pickup truck
Human Resources: 2-person hand labor crew for 4 weeks

Action 6: Plant Irrigation

To ensure vigorous growth of native vegetation, during the seasonal dry periods of the first three years after fall revegetation, the plants will need to be fertilized and watered. Care will be taken not to overwater the plants, since this could encourage shallow root development and dependence on watering. Similarly, fertilizer should be applied cautiously. Water will be diverted from Rainbow Creek to irrigate reclaimed sites only if the National Park Service has sufficient water rights for such use. A gravity feed and drip irrigation system would be the most effective way to irrigate the plants. This system will need weekly maintenance.

Time: on levee, spring and summer 1995; in pit, July through August 1996, 1997, and 1998.
Material: fertilizer, lime
Equipment: old fire hose, water sock
Human Resources: 2-person crew for 1 week to install system; 1 person to maintain for 1 day per week

Action 7: Monitoring

Monitoring will be done in accordance with the Company Creek pit monitoring program.

Former Extraction Sites

Historically, valley residents and public agencies have extracted mineral materials from numerous locations along the river corridor and other sites in the valley. Governmental entities that have extracted mineral materials include the National Park Service; the Forest Service, U.S. Department of Agriculture; the Chelan County Public Utilities District; the Washington Department of Wildlife; and Chelan County road crews. More than any other factor, ease of access seems to have dictated the locations where mineral material extraction occurred.

Except for the Rainbow Creek pit, none of the extraction sites within the boundaries of Lake Chelan National Recreation Area will be subject to active reclamation. Most of them are small, and many are in advanced stages of natural recovery with native plant cover and do not harbor non-native species. Recovery of these sites will be monitored.

Specific known sites in Lake Chelan National Recreation area that were used for extraction of minerals are shown on the Company Creek Pit Location & Old Borrow Sites map and listed in table 5, along with dates of use, reclamation status, area disturbed, and volumes removed (if known). Undoubtedly other sites have been used for mineral material extraction that are not included in the table. Chelan County road crews used numerous sites before 1968 in the area before it was managed by the National Park Service. Those sites are not included in the table or in the discussion that follows. The known information about some sites and surrounding resource values is summarized in the following paragraphs.

FROG ISLAND

Frog Island, a gravel extraction site that has not been used since 1960, is about 140 feet southwest of the main valley road between the Stehekin river and a small side channel at river mile 3.26. Most of the material removed from this site was used to build the bridge approaches on either side of harlequin bridge in 1948. An estimated 12,000 cubic yards was removed from this site. Signs of gravel removal — heavy equipment tracks and furrows in the gravel bar — still exist. The material consists of well-sorted cobble, gravel, and sand. Access to the site was a short, lightly constructed route off the main valley road. Any vehicular access to this site would require fording the side channel of the river, which runs almost year-round.

The Frog Island site is clearly visible from both the main valley road and the main river channel. It is quite low, and cottonwoods thrive due to the high water table. Surrounding overstory vegetation consists of red-stem dogwood, young, thick stands of red alder, bigleaf maple, and cottonwoods. Anglers occasionally use the site for access to a deep hole and backwater immediately downstream from the site. No private land exists adjacent to the site. Good understory browse is available, providing deer a relatively safe location for fawning. Deer frequent the gravel bar during fawning season and in winter. Overall, this site is recovering rapidly because it is frequently flooded by the Stehekin River.

CLARK'S PIT

Clark's Pit is a small site on a medium-sized gravel bar located between two

TABLE 5: SAND, ROCK, AND GRAVEL EXTRACTION SITES IN THE STEHEKIN VALLEY, 1948–1994

Years of Use	Extraction Site	Reclamation Status	Acreage	Cubic Yards Used
1948–1960	Frog Island	naturally recovering gravel bar	5.3	12,000
Late 1950s–1980s	Clark's Pit (private)	naturally recovering gravel bar	1.1	10,000
1965–1966	Bear Island	naturally recovering gravel bar	1.5	unknown
Mid-1960s–1980s	Brownfield's Site	naturally recovered	0.2	1,200
1960s–1980s	Lower Golf Course Pit	naturally recovering	0.5	20,000
1973	Boulder Creek Pit	naturally recovering gravel bar	0.3	9,600
1972–1973	Lower Field Site	naturally recovering, use as shooting range	0.3	3,000
1973–1974	Rainbow Creek Pit	reclamation work needed	1.0	25,000
Mid-1970s	Nine Mile Pits	naturally recovering, install access barriers	0.2	10,000
1981–1982	School Talus Slope	naturally recovering	0.3	800
1979–1984 (86?)	unknown source	unknown	—	613
1981	Company Creek Pit	reclamation work needed	—	25,000[a]
1982–1989	Company Creek Pit	reclamation work needed	—	1,200[a]
1990–1994	Company Creek Pit	reclamation work needed	2.1	8,931[b]
unknown	Battalion Creek Pit (private)	naturally recovering	0.6 (0.1 NPS)	unknown
unknown	Chelan County PUD	naturally recovering	0.4	unknown
unknown	Old Dump (lower)	unknown	0.3	unknown
unknown	Old Dump (upper)	unknown	0.1	unknown
unknown	Burn Pile	unknown	0.2	unknown
unknown	Golf Course (only soil extracted)	unknown	0.1	unknown
46 years of use	Total		15.7	127,344
	Average Annual In-Park Use			2,768

a. Estimated use may be low because records are incomplete.
b. Includes only material taken from the Company Creek pit.

flowing channels of the river just upstream from the mouth of the river, at river mile 0.4. The site and its access are privately owned. The material at this site, which is poorly sorted, ranges in size from 8" diameter rounded cobbles to sand. The site has been used since the early 1970s and possibly earlier. Roughly 8,000–10,000

cubic yards of gravel have been removed and used by individuals primarily for fill material on private land at the head of Lake Chelan. Small amounts of material have been used for cement aggregate and possibly some drainage rock.

Clark's Pit is clearly visible from the Stehekin River Trail, the main river channel, and adjacent private lands. Little vegetation exists on the gravel bar, and the site is normally flooded each year during spring snowmelt. Access requires fording a flowing channel during all but the lowest flows of the river. The gravel bar is frequently used by fishermen for access to deep pools and a riffle to the south and east of the site.

BEAR ISLAND

The Bear Island gravel site is on a large gravel and sand bar near river Mile 4.1. Access to the site is a half-mile-long, lightly constructed road that turns off from the Company Creek Road near the Chelan County PUD generating facility, fords Battalion Creek, and crosses a small peninsula-like area known as Bear Island, which lies between Battalion Creek, Company Creek, and the Stehekin River.

This site was opened by the Chelan County PUD to obtain cement aggregate for the construction of their original powerhouse in 1965. It also has been used periodically since 1966 by private parties to obtain sand and cement aggregate extraction. An unknown amount of material has been removed from this site. The material present is well sorted gravels, sand, and some cobble. It is especially suitable for cement aggregate.

The Bear Island site is marginally visible from the Stehekin Valley Road, especially during late fall and winter, when leaves have fallen from deciduous trees. It is clearly visible From the main river channel. Red alder and cottonwood are rapidly invading this bar and appear to be growing rapidly. The vegetation on Bear Island away from floodway consists of large Western red cedar, grand fir, Douglas-fir, and a few ponderosa pine.

Several large holes exist in the gravel bar from past gravel removal. They are filled with water in much of the summer. There is little human use at this site. Because of the necessity of fording a stream to gain access to the gravel bar, few anglers or recreationists use the area. The site is heavily used by wildlife, including bear, deer, beaver, and other mammals and birds. The dense forest canopy provides well-insulated winter habitat for deer.

BROWNFIELD'S SITE

The Brownfield's site is near the U.S. Geological Survey cable crossing of the Stehekin River at river mile 0.98. It is public land administered by the National Park Service. The material at this site includes smaller cobbles, gravel, and sand. Most material is poorly sorted. This site, which has not been used since the mid-1960s, shows little impact from past extraction. The material removed from this site was used for road maintenance and minor fill needs. An estimated 1,200 cubic yards of material was extracted. River channel changes are evident since this site was last used. Little area now exists that is not under water during most of the year. Access to this site was a narrow, poorly defined road that has recovered well and shows little impact.

The Brownfield's site is marginally visible from the Stehekin River Trail and clearly visible from the main river channel. Anglers regularly visit this area of the river, particularly a large deep pool just upstream. There is no private land within

200 feet of the site. Vegetation on the northeast bank consists of densely canopied Douglas-fir and grand fir, interspersed with occasional cottonwoods and Western red cedar.

LOWER GOLF COURSE GRAVEL PIT

The Lower Golf Course gravel pit is located at river mile 3.1 on the southwest side of the river. This pit has been the major extraction site for river gravels, sand, and cement aggregate for the past 20 years. Major past users of this site are the National Park Service, the Washington Department of Game, Chelan County, and Stehekin valley residents. Unknown quantities of material have been removed, probably in excess of 20,000 cubic yards.

The Lower Golf Course site consists of a large gravel bar with well-sorted cobble, gravels, and some sand. The entire site is usually flooded each year during the snowmelt period. Access to the site is by a constructed road nearly 0.5 mile in length that leads from Harlequin Campground on the southwest side of the river.

The Lower Golf Course site is distantly visible from the main valley road and readily visible from the main river channel. Surrounding overstory vegetation includes Western red cedar, grand fir, bigleaf maple, cottonwood, red alder, redstem dogwood, and Douglas-fir. Flooding and channel changes during the 1980s made this site inaccessible. Large amounts of water running in the channel formed by the access road scoured a deep and rough gully that is impassable to trucks or other wheeled vehicles. The gully formed in the access road is now much lower than the surrounding landscape and as a result serves as a flood channel each year.

BOULDER CREEK PIT

The National Park Service opened the Boulder Creek extraction site during road improvements and paving in 1973. Most of the material was used for fill along the lakeshore adjacent to the road. It has not been used since then. The pit is adjacent to Boulder Creek approximately 150 feet north of the main valley road near road mile 2.3. The area is dry except during very high flows of Boulder Creek during snowmelt. Approximately 9,600 cubic yards of material were removed from this pit in 1973. The material consists of poorly sorted boulders up to 50" or greater in diameter, cobble, and some smaller gravels. All of the material is transported moraine deposits. The material is suitable only for fill and possibly drain rock.

The Boulder Creek pit site is easily visible from the main valley road and adjacent private property. The access road, which is no longer visible, consisted of a bulldozed access route from the valley road. Subsequent flooding removed most traces of this route. The vegetation surrounding the pit is open-canopied Douglas-fir and some ponderosa pine. The pit surface shows significant vegetative recovery since the pit was closed. Ponderosa pine seedlings are numerous, despite excessively drained and very poorly developed soil.

LOWER FIELD SITE

The Lower Field site is on public land near the 7.6 mile point of the Stehekin valley road. Originally opened by the National Park Service for road improvement and construction in 1972, the site was occasionally used throughout the 1970s for small quantities of fill material needed by the National Park Service. An estimated 3,000 cubic yards of material was removed from this site.

The site is an alluvial deposit resulting from overland flow and side stream flooding from the high ridges immediately to the north. The material consists of silt and fine sands with little rock or gravel. The material ls suited only for fill material.

Access to the Lower Field site is from a constructed roadway approximately 600 feet long that turns off the valley road. The site is not visible from the valley road during summer when leaves are on the deciduous trees. Neither is the site visible from the river channel. It is marginally visible from the road during winter. The overstory vegetation surrounding the site consists of nearly pure stands of bigleaf maple interspersed with Douglas-fir and grand fir, with Pacific dogwood and red alder in the understory.

At present, the site serves as a designated firing range for the National Park Service and the public during hunting seasons. The Lower Field extraction site will continue to be used as a rifle range, and left in its present state of natural recovery.

RAINBOW CREEK PIT

The Rainbow Creek pit, for which rehabilitation is discussed in a previous chapter, is adjacent to Rainbow Creek and about 300 feet west of the main valley road near road mile 3. The National Park Service opened this site during road improvements and paving in 1973–1974. For about 3 months a rock crusher occupied the site, crushing chips and base material. The National Park Service continued to use the pit for intermittent needs until 1980. Approximately 25,000 cubic yards of material was removed from this site. The material was used almost entirely for fill, chips, and base course material for road maintenance and improvement.

Material at the Rainbow Creek pit is similar to that at the Boulder Creek site, although the boulders are somewhat smaller and there are more fine gravels and sand. As in the Boulder Creek site, the material originates from stream-reworked moraine deposits. Access to the pit consists of a constructed road. One parcel of private property is adjacent to the site.

The Rainbow Creek pit is not visible from the main valley road or the Stehekin River. lt is clearly visible from the Rainbow Loop trail and adjacent private property. The site is dry and shows considerable impact from past extraction and crushing activity. A layer of crushed chips and base material covers the soil, and little vegetation has returned to the area. The surrounding forest consists of open canopy Douglas-fir and some ponderosa pine.

NINE MILE PITS

The Nine Mile Pits area consists of several small sites where past NPS and county road maintenance and construction crews extracted fill material. The material, which originates from old river terraces, consists of poorly sorted gravel, coarse sand, and cobble. The National Park Service opened the largest site in the mid 1970s to obtain fill for road widening and improvement to the section of road between the 10 mile and 11 mile points. The material at this site is much finer and contains a higher fraction of silts than the other nearby pits.

Approximately 6,000 cubic yards of material were removed from this pit during the period for the work. Unknown quantities were removed from other pits; the total probably exceeds 10,000 cubic yards. All pits have been regraded along excavated sides and physically blend into surrounding landforms fairly well. However, all sites are excessively well drained and vegetation recovery is very slow.

Access to each site consisted of short roads immediately off the valley road. There is no private property within 0.5 mile. Surrounding overstory vegetation consists of Douglas-fir with a few isolated ponderosa pine and bigleaf maple. All sites are clearly visible from the road. None of the sites are visible from the river.

The Nine Mile Pits will be closed to vehicle traffic by placing three to four large boulders in the entrance.

SCHOOL TALUS SLOPE

The National Park Service opened the School Talus Slope site in 1981 to obtain riprap material. The site is a steep talus slope 60 feet northeast of the main valley road near road mile 3. The material at this site consists of large angular rock up to 120 inches in the longest dimension that has exfoliated from steep cliffs above. The National Park Service removed an estimated total of 800 cubic yards of material for use as riprap along the lakeshore or on riverbanks along the road during flood damage repairs in 1981. Private individuals have removed a small but unknown quantity of rock from the site for use as building stone.

Access to the School Talus Slope site is a short access route that was never improved and has since partially recovered from the impacts of trucks and equipment. The site, which is clearly visible from the main valley road, shows significant impacts from the rock removal. Some loose rock has slid down from above to cover voids where lower rock was removed; however, the lighter unoxidized rock contrasts dramatically with the undisturbed adjacent talus.

Although the site will never support significant vascular vegetation, lichens and mosses will eventually cover the newly exposed rock. Surrounding vegetation includes open canopy Douglas-fir and a few scattered ponderosa pine and bigleaf maple. No private property is adjacent, but the old Stehekin school site, which is on the National Register of Historic Places, is only 300 feet to the north. The new school site, owned by the Stehekin School District, is about 450 feet to the south.

BATTALION CREEK PIT

The Batallion Creek site is located on a gravel and sand bar near river mile 4.7. The gravel bar is on public land administered by the National Park Service that adjoins private land to the south. The gravel bar is quite large and is normally flooded each year. Significant bank erosion occurred on the north side of the river immediately downstream from this site during the past 15 years.

Access is by a lightly constructed road approximately 0.125 mile in length that turns off the Company Creek road approximately 1.2 miles from Harlequin Bridge. The access road is on public land. The material at this site consists of well-sorted gravels, sand, and some cobble. This material is suitable for cement aggregate, sand, and, if screened, drain rock.

The Batallion Creek gravel bar is normally under water each year during the snowmelt and has only a few red alder growing on the bar. The site is visible from the valley road and the main river channel. The overstory vegetation surrounding the site consists of Western red cedar, large Douglas-fir, grand fir, cottonwoods, and red alder. Anglers normally do not frequent this site. Immediately downstream from the site private property owners have initiated bank protection measures on private land on both sides of the river to prevent further erosion.

Mitigating the Impacts of Material Importation

MEASURES TO MITIGATE IMPACTS

The following measures are recommended to reduce the impacts of importing sand, rock, gravel, and soil into Lake Chelan National Recreation Area.

Use commercial sources of sand, rock, gravel and soil that are free of noxious weeds or other deleterious material such as oil and fuels.

If commercial vendors can not guarantee material to be free of noxious weeds and deleterious material, inspect the material source site for noxious weeds or deleterious material.

Do not import metal mine tailings with high concentrations of minerals that could cause soil or water pollution.

Monitor sites where imported material is used or stored for noxious weeds, and promptly control them if found.

Notify Chelan County if noxious weeds are found on private land and owners fail to control the weeds. Chelan County has the authority to "order prompt control action" under the Revised Code of Washington 17.10.170.

Store imported NPS material at the existing pit or other previously disturbed areas designated by the park staff.

Avoid storing imported material near wetlands or streams. If fine material or soils are stored within 200 feet of a wetland or a stream, use a silt barrier to control erosion.

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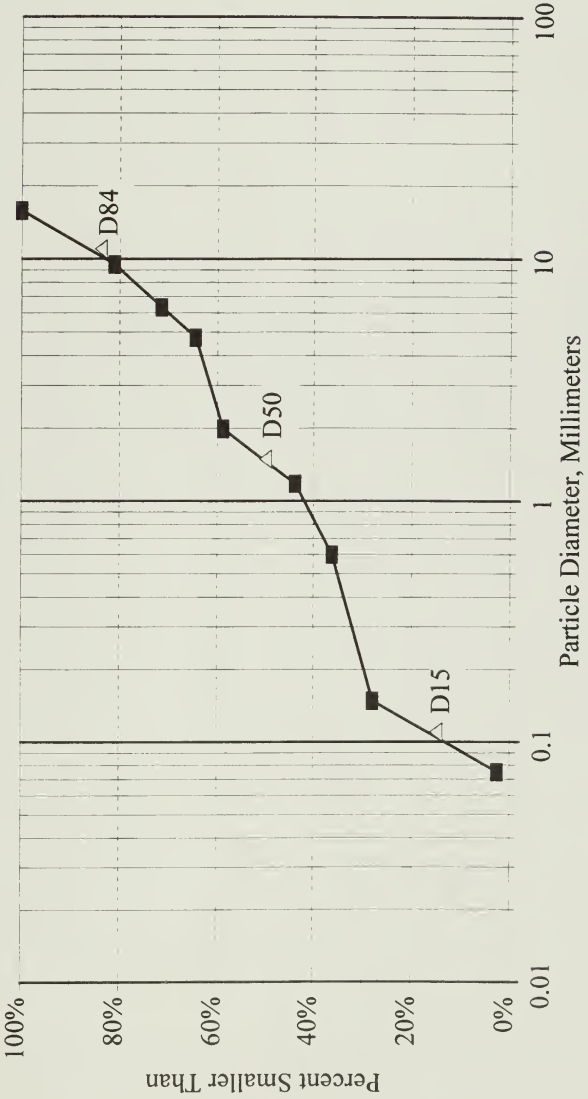


Note: An estimated 30% of the material at Company Creek Pit is greater than 16mm and was not included in the sample. Therefore, this sample analysis represents 70% of the material. Median particle diameter (D50) equals 1.5mm.

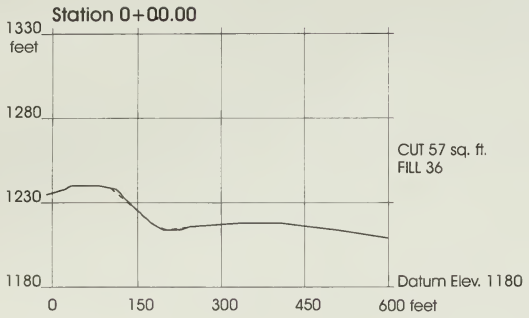
APPENDIX B: MINING PLAN VOLUME CALCULATIONS AND CROSS SECTIONS

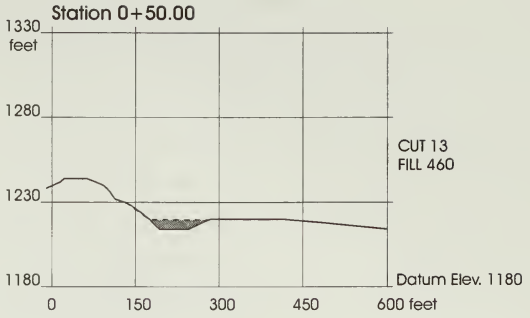
Table B-1 includes cut and fill areas and volumes for cross-section stations spaced at 50-foot intervals. The location of these cross-sections are shown on the mine plan maps (pp. 21-22). The figures on the following pages show the cross-sections for the 10-year, 20-year, and long-term mine plans. The figures include cross-sections for stations located at 50-foot intervals on gradual sloping areas and 10-foot intervals on steep areas. The 10-foot cross-section cut-and-fill measurements were used to account for the greater elevation changes in steep areas.

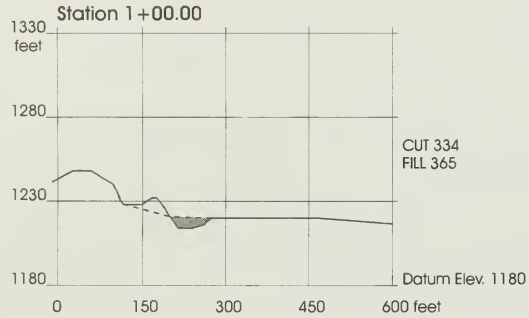
TABLE B-1: VOLUME CALCULATIONS FOR COMPANY CREEK PIT CUT AND FILL

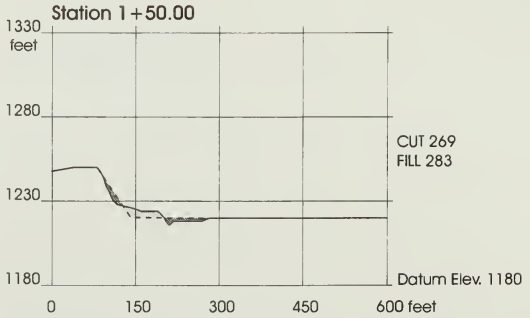
Station	Fill (sq. ft.)	Cut (sq. ft.)	Interval	Fill (cu. yd.)	Cumulative Fill	Cut (cu. yd.)	Cumulative Cut (cu. yd.)
0 + 0	36	57	0	0		0	
0 + 50	460	13	50	459	459	65	65
1 + 00	365	334	50	763	1,222	321	386
1 + 50	283	268	50	600	1,822	557	943
2 + 00	555	14	50	775	2,597	261	1,204
2 + 50	543	470	50	1,016	3,613	448	1,652
3 + 00	6	6,952	50	508	4,121	6,872	8,524
3 + 50	0	8,705	50	6	4,127	14,497	23,021
4 + 00	0	9,491	50	0		16,847	39,868
4 + 50	0	10,096	50	0		18,136	58,004
5 + 00	0	10,916	50	0		19,456	77,460
5 + 50	0	9,845	50	0		19,224	96,684
6 + 00	0	8,943	50	0		17,396	114,080
6 + 50	0	9,051	50	0		16,661	130,741
7 + 00	0	9,595	50	0		17,265	148,006
7 + 50	0	10,187	50	0		18,317	166,323
8 + 00	7	10,029	50	6		18,718	185,041
8 + 50	0	9,584	50	6		18,160	203,201
9 + 00	0	92,785	50	0		17,465	220,666
9 + 50	0	8,550	50	0		16,507	237,173
10 + 00	1	9,440	50	1		16,657	253,830
10 + 50	0	9,746	50	1		17,765	271,595
11 + 00	0	8,572	50	0		16,962	288,557
11 + 50	0	6,778	50	0		14,213	302,770
12 + 00	0	5,538	50	0		11,403	314,173
12 + 50	0	4,265	50	0		9,076	323,249
13 + 00	16	186	50	15		4,121	327,370

Total FILL from Station 0 + 00 to 3 + 50 = 4,127 cubic yards
Total CUT from Station 0 + 00 to 13 + 00 = 327,370 cubic yards









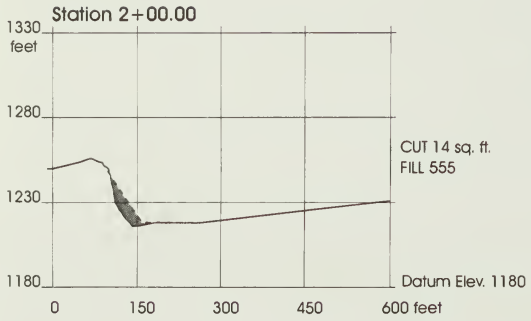
Cut
Fill
Surface
Regrade

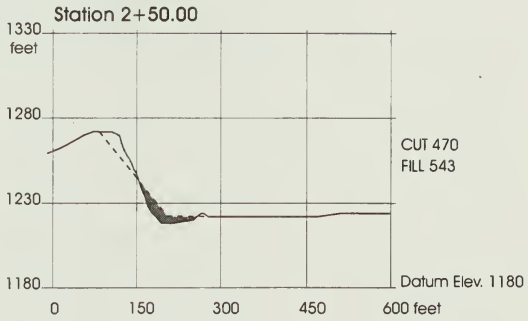
B-1-A: Cross-Sections for 10-Year Mine Plan

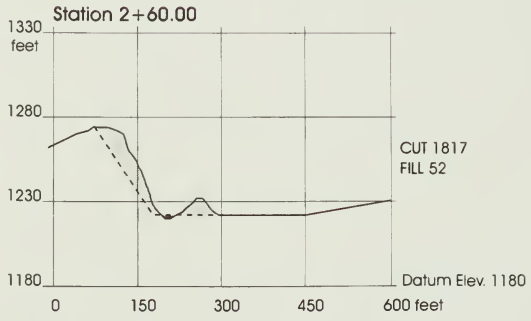
Company Creek Pit

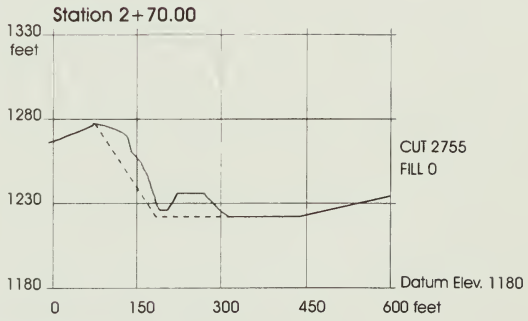
LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE









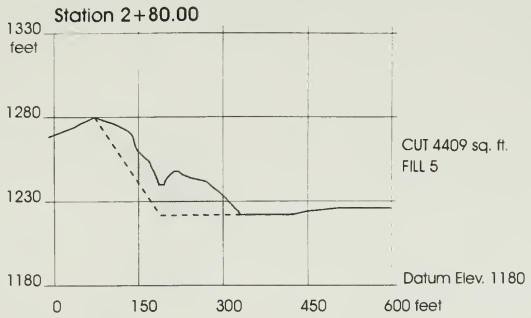
Cut
Fill
Surface
Regrade

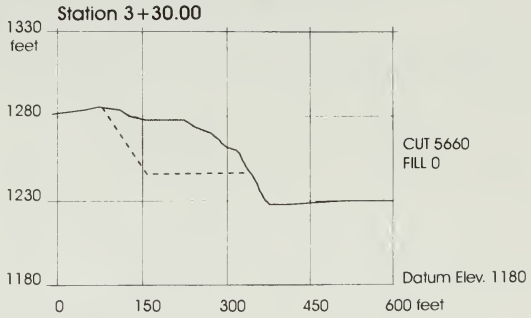
B-1-B: Cross-Sections for 10-Year Mine Plan

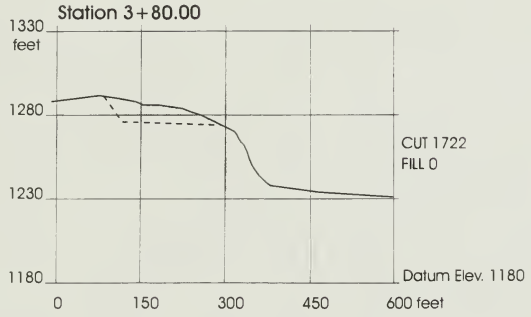
Company Creek Pit

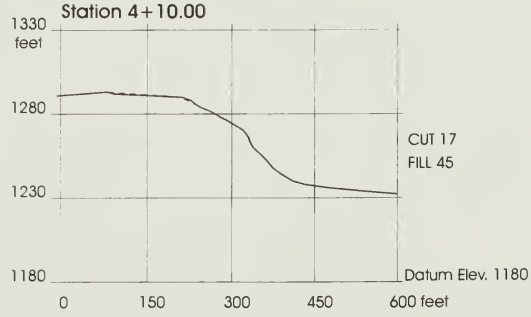
LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE







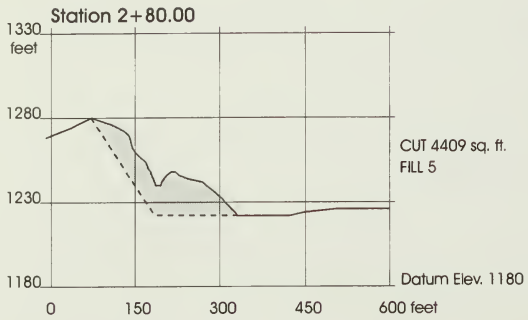


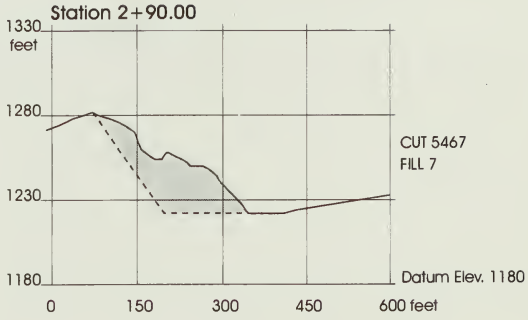
B-1-C: Cross-Sections for 10-Year Mine Plan

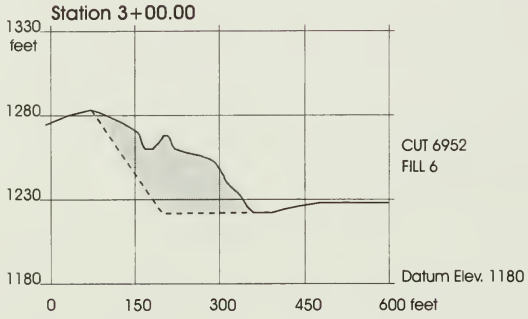
Company Creek Pit

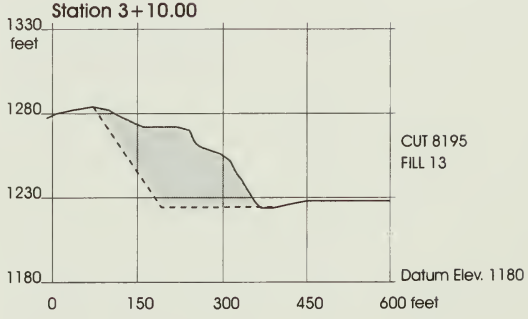
LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE









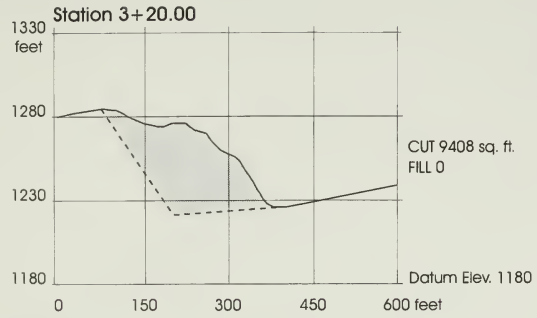
Cut
Fill
Surface
Regrade

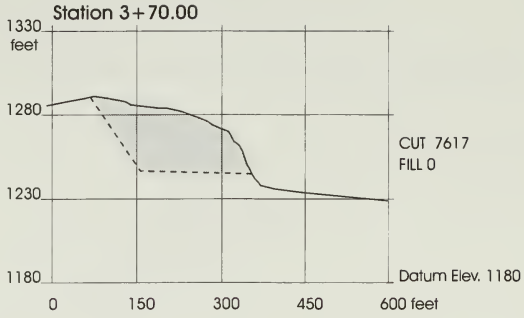
B-2-A: Cross-Sections for 20-Year Mine Plan

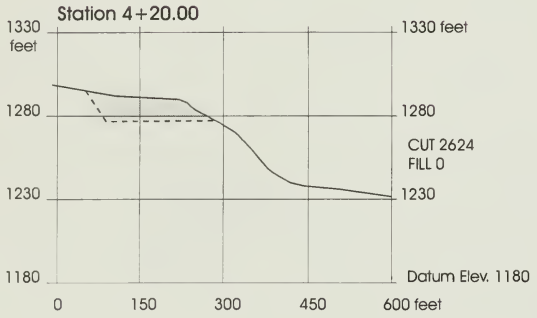
Company Creek Pit

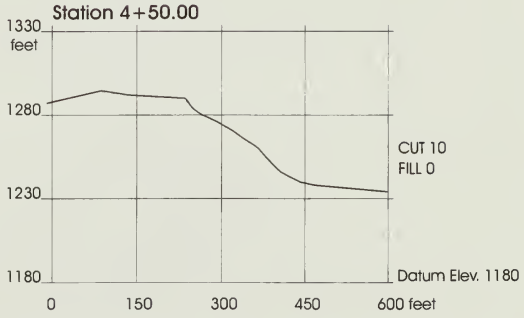
LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE







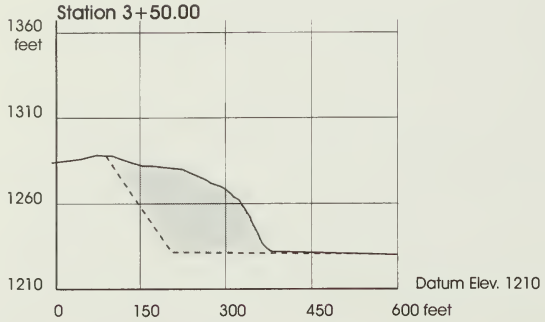


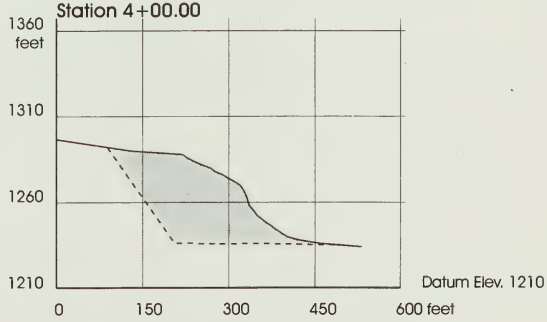
B-2-B: Cross-Sections for 20-Year Mine Plan

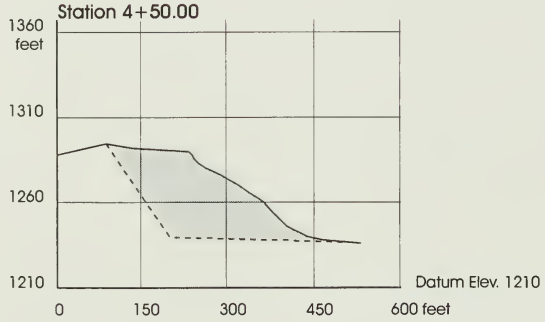
Company Creek Pit

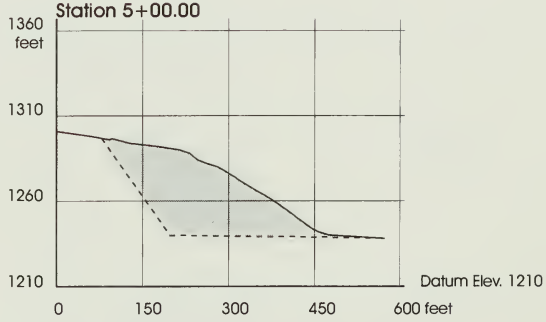
LAKE CHELAN NATIONAL RECREATION AREA

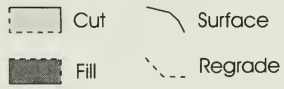
UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE









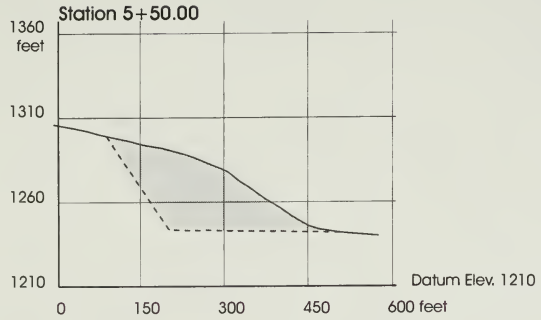


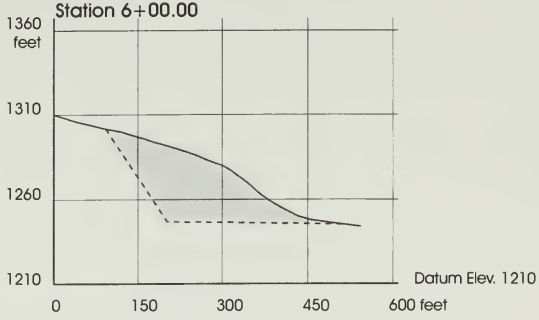
B-3-A: Cross-Sections for Long-Term Mine Plan

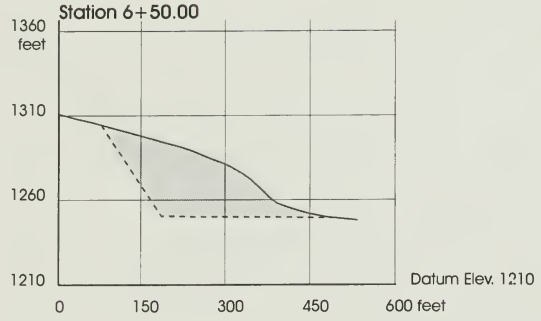
Company Creek Pit

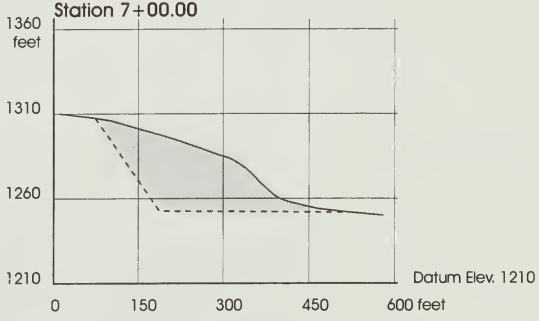
LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE







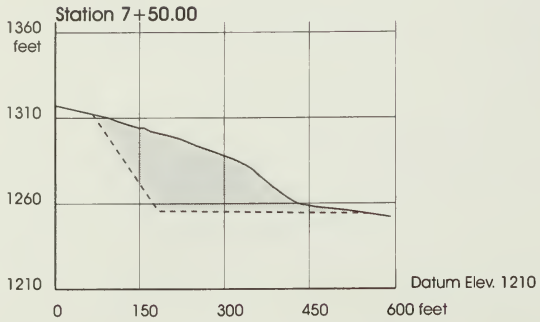


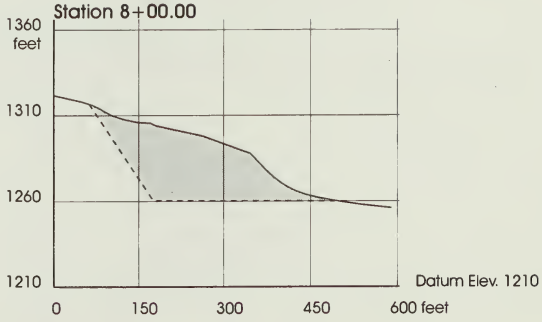
B-3-B: Cross-Sections for Long-Term Mine Plan

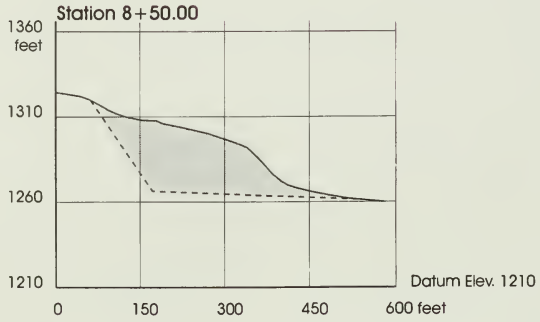
Company Creek Pit

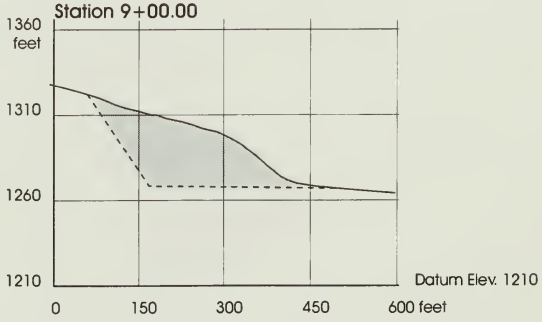
LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE







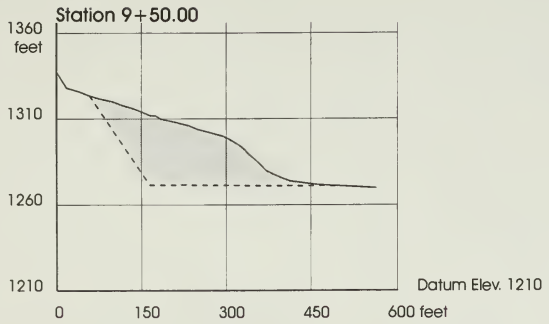


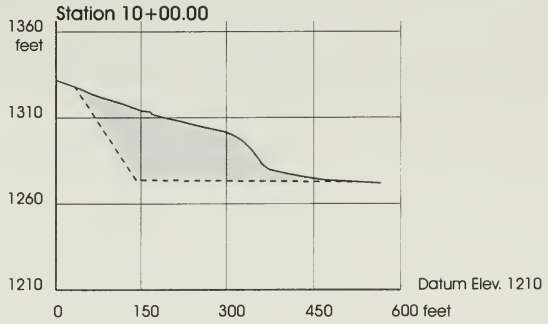
B-3-C: Cross-Sections for Long-Term Mine Plan

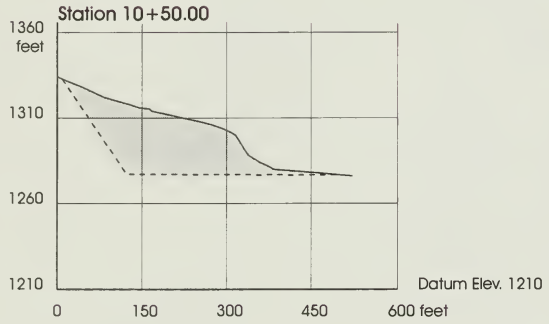
Company Creek Pit

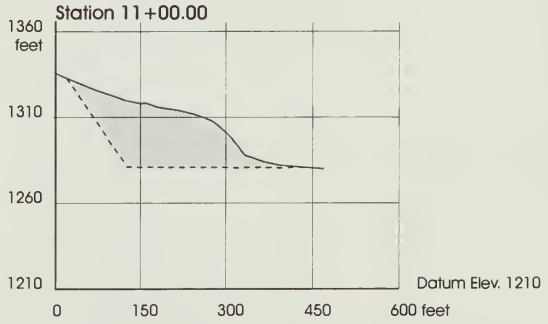
LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE







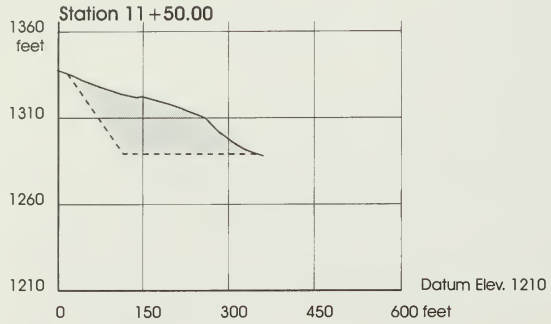


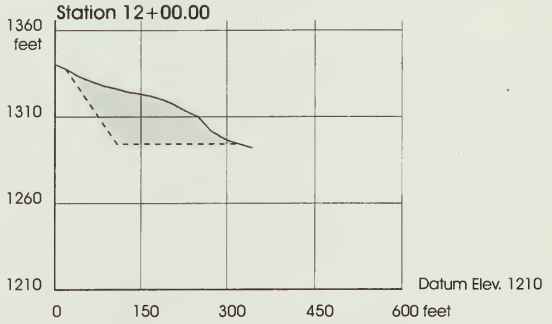
B-3-D: Cross-Sections for Long-Term Mine Plan

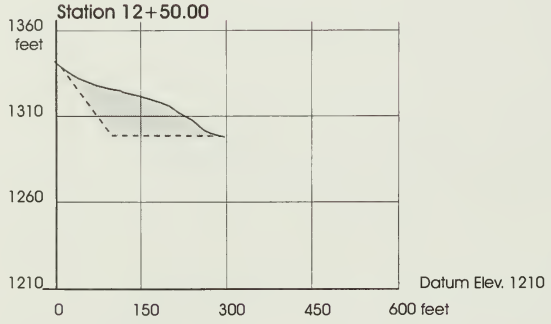
Company Creek Pit

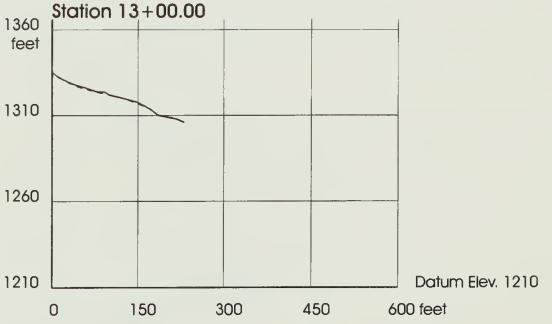
LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE









B-3-E: Cross-Sections for Long-Term Mine Plan

Company Creek Pit

LAKE CHELAN NATIONAL RECREATION AREA

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

APPENDIX C: CALCULATIONS FOR PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Project LACH Company Creek Pit
Date 2/18/95

WORKSHEET NO. 5A

PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity: Gravel Pit extraction - Dozer will push material downslope from top of pit highwall at ≈ 2½:1. Material will be stockpiled on the pit floor at the base of the extraction slope.

Characterization of Dozer Used (type, size, etc.):

D7U

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.):

* Material extraction and stockpiling
* Cat would mobilize out of Chelan, Wa.
* Material is a poorly sorted glacial outwash terrace - fine sand to boulders

* push distance = 100'
* grade = 20% - 27°
* material weight = 2900 lb/cy (2.2 ton/cy = 1 cy)

Productivity Calculations:

Operating Adjustment Factor = .80 (operator factor) × .90 (material factor) × .80 (work hour factor) × .95 (grade factor) × .80 (weight correction factor) × .80 (production method/blade factor)

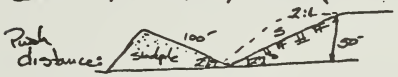
1.0 (visibility) × 1.0 (elevation) × .80 (direct drive transmission) = .280

Net Hourly Production = 650 (normal hourly production) × .280 (operating adjustment factor) = 182 yd³/hr

Hours Required = 17400 yd³ (volume to be moved) ÷ 182 yd³/hr (net hourly production) = 96 hrs ÷ 40 hr weeks = 2.5 weeks

Cost: D7/hr ≈ $110/hr with operator (N.Calif.) Total = $10,560.00 + Mobilization

Push distance:



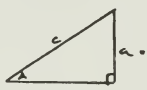
$s = \frac{50'}{\sin 27°} = 110'$ Push distance ≈ 100'

Data Sources:

CATERPILLAR PERFORMANCE HANDBOOK, ed 15, 1984

Current depth of excavation: post excavation survey #2 9/17/95

section	slope	toe angle	crest angle	depth
14	65	53°	93°	50'
16	60	31°	95°	40'
18	60	31°	100°	62'
20	60	31°	97°	50'
22	68	34°	96°	50'
24	65	33°	91°	49'
	avg	32	94	50



$a = c \sin A$

Project LACH Company Creek Pit
Date 2/18/95

WORKSHEET NO. 9 B

PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:
Gravel Pit extraction - Dozer will push material downslope from top of pit highwall (50' high at 2:1. Material will be stockpiled on pit floor at the base of the extraction slope (see worksheet 6A)

Characterization of Dozer Used (type, size, etc.):
D8U

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.):
* Material extraction & Stockpiling
* Mobilize out of Chelan, Wa
* Push sorted glacial outwash terrace
+ push distance = 100'
+ Grade = -2:1 and +2:1 = 27°
* Material weight = 2900 lb/LCY ($\frac{27}{210}$ = .8)

Productivity Calculations:

Operating Adjustment Factor = .80 (operator factor) x .90 (material factor) x .80 (work hour factor) x .95 (grade factor) x .80 (weight correction factor) x .80 (production method/blade factor) x

1.0 (visibility) x 1.0 (elevation) x .80 (direct drive transmission) = .280

Net Hourly Production = 1100 (normal hourly production) yd^3/hr x .280 (operating adjustment factor) = 308 yd^3/hr

Hours Required = 17,400 yd^3 (volume to be moved) ÷ 308 yd^3/hr (net hourly production) = 57 hrs ÷ 40 hrs/week = 1.5 weeks

Cost D8/hr ≈ 135 with operator (N. Calif) | Total = $7695.00 | + Mobilization
$2865 cheaper than a D7

Data Sources:
Caterpillar Performance Handbook, ed 15, 1984

APPENDIX D: SEED AND FERTILIZER RATE CALCULATIONS

TABLE D-1: CALCULATIONS FOR SEEDING MIXTURES FOR COMPANY CREEK PIT RECLAMATION

Species	Number of Seeds per Pound	Seeds per square foot @ 1 pound per Acre	Desired Number of Seeds per Square Foot	Required Pounds of PLS[a] Per Acre at 100%	Percentage of Species Desired in Mix	PLS Pounds Seed Rate by Species	Acreage to be Seeded	Pounds of PLS Needed per Species
Agropyron spicatum	140,000	3.21	40	12.45	30%	3.73	1	3.73
Elymus glaucus	110,000	2.53	40	15.84	30%	4.75	1	4.75
Antennaria parvifolia	7,000,000	160.70	60	0.37	30%	0.11	1	0.11

a. PLS = pure live seed.

FERTILIZER CALCULATIONS

The desired fertilizer rate is 50 pounds of usable nitrogen per acre; the fertilizer analysis is 16–4–6.

If 1 pound of fertilizer is 16 percent nitrogen, then

$0.16/1 = 50/x$

$0.16x = 50$

$x = 50/0.16$

$x = 312$ **pounds** of 16–4–6 fertilizer is needed to get 50 pounds of nitrogen on 1 acre.

PRICE DETERMINATION AND COST COMPARISON

SAND, ROCK, AND GRAVEL PLAN

FOR THE

LAKE CHELAN NATIONAL RECREATION AREA

by

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PRICE DETERMINATION AND COST COMPARISON
SAND, ROCK, AND GRAVEL PLAN
LAKE CHELAN NATIONAL RECREATION AREA

PURPOSE

The purpose of this economic determination is to establish a fair market value or selling price of sand, rock, and gravel to private users in the Stehekin Valley from the Company Creek Pit Deposit, Lake Chelan National Recreation Area, which adjoins North Cascades National Park. The unit was established October 2, 1968, and consists of about 61,887 acres of which 2,593 are nonfederal. The enabling legislation (P.L. 90-544, Title II, §202, Oct. 2, 1968, 82 Stat. 927) states at §90c-1(b):

> "That within that portion of the Lake Chelan National Recreation Area which is not designated as wilderness, sand, rock and gravel may be made available for sale to the residents of Stehekin for local use so long as such sale and disposal does not have significant adverse effects on the administration of the Lake Chelan National Recreation Area."

The following study documents the facts, the assumptions, and the reasoning to establish a defendable selling price to local residents of sand, rock, and gravel from the park pit based on economic and market considerations.

INTRODUCTION

The Uniform Appraisal Standards for Federal Land Acquisitions, Interagency Land Acquisition Conference 1992 (UAS) sets standards to promote uniformity in the appraisal of real property, but its primary function is for acquisition by both direct purchase and condemnation. Therefore, many of the principles of fair market value determination will have their roots in the UAS, but the price setting of a commodity mined by the NPS or a contractor will follow economic principles found in any of the microeconomics text books and the numbers derived from factors established in the open market place. Just compensation to obtain the mineral commodity (i.e., selling price) will mirror the market price prevailing at the time and place of taking of that commodity.

The isolated location of the subject deposit near Stehekin has created somewhat of a monopoly situation in that there is little competition possible in the immediate area because most of the suitable land is under park ownership. However, private land does exist for the possibility of a private pit. Currently, indirect competition comes by barge from down the lake about 60 miles to the south near the town of Chelan. The additional increase in value from the transportation cost is a major concern. Finally, this evaluation assumes that the park is in compliance with "Special Directive on the Administrative Use of In-Park Borrow Material (August 1, 1991)" and that the "Data for Lake Chelan NRA, Sand, Rock, and Gravel Plan" (October 31, 1994), and notes from Steve Culver and Mark Ziegenbein are assumed to be reasonably accurate.

ANALYSIS

The unit price ($/ton or $/cubic yard) of mineral material is related to the scale of the operation. In general, large scale mining operations have lower unit costs, and therefore, lower prices can be set than at small scale operations. Economies of scale will usually allow the large manufacturer an advantage in setting prices and obtaining a larger share of the market activity. However, there are exceptions. The estimated 2,700 cubic yards per year (cy/y) production rate (based on the past 46

years) constitutes a very small mining operation. Standard statistical information for nationally operated sand and gravel operations range (million tpy) from <.25 to >1.5 in increments of .25.

To analyze a project of 2,700 cy/y, places it at about 4,000 tons per year (tpy) or .004 million tpy. The *Rock Products* trade journal (June 1994) lists the price (90 percent of operations in the US) of 1 ton of concrete sand from $2.50/ton to $9.00/ton FOB the plant site. The list price of 1¼-inch crushed stone ranges between $2.50/ton and $9.00/ton FOB the plant site. This study for Lake Chelan mineral materials will not attempt to analyze the traditional inputs to price of capital equipment and operating costs like energy, labor, maintenance, environmental controls, reclamation, etc. Suffice it to say that a successful mining venture would sell its product for a price that would cover total costs and give a return on investment. By charging a price equal to the competition, the park would provide a commodity that is price-neutral with the private sector and provide no incentives to purchase material from the park.

However, the barge transportation is a cost differential that the park does not have to pay except for capital equipment delivery and supplies. These items have to use barge transportation to get to the mining site. The following information was provided by the park and is helpful in the determination of a fair price.

Material Types – Commercially available materials include: Rip-rap, 3/4" and 1½-inch washed river gravel, decomposed granite, granite sand, "concrete" sand, and state spec 5/8-inch surface aggregate. These are standard materials. Other materials and/or mixtures may be processed as specified.

The Stehekin pit is capable of producing a gravel mixture suitable to meet the Federal Highway Specification for grading design "E":

Size	% Passing
1"	100
3/4"	97–100
3/8"	67–79
No. 4	47–59
No. 40	12–21
No. 200	4–8

This mix design is commonly used as a road base and was used for the Stehekin Valley road. In the past, the portable crusher used at the pit has not been able to crush rocks 10 inches and larger. A larger crusher could be purchased or reject will continue to be a disposal problem.

Material Sources – The two commonly used commercial suppliers are Chelan Concrete Company and the Tunnel Hill Granite Company. Chelan Concrete uses the Chelan pit on the east side of Chelan, and it is assumed that Tunnel Hill Granite Company uses Don Coleman's material from 2 to 3 miles south of Lake Chelan off Highway Alt.97. There are nine permitted quarrying operations of 3 acres or larger within an approximate 24-mile radius of the City of Chelan according to records of the Division of Geology and Earth Resources in the Washington State Department of Natural Resources (Contacts: Dave Norman, 206-902-1439) and Lorraine Powell (509-925-6131, in the Southeast Office located in Ellensburg). Initial inquiries of the subject with the Bureau of Land Management and U.S. Forest Service were directed to the DNR.

Pits within a 24-mile radius of Chelan:

Chelan Pit
Goodfellow Brothers, Inc. (Chelan City)
Goodfellow Brothers, Inc. (Douglas City)
Staples Pit
Donald Coleman
Centennial Contractors, Inc.
Coyote Pit
Northwest Paving & Rock Products
Godbey Red-E-Mix Concrete, Inc.

Material Costs (Price) – The average price of pit run material is $3.00/cy.

The average price of the processed material itself (additional transportation costs exist) is listed below:

Rip-rap	$10.50/cy
Washed river gravel	8.00/cy
Decomposed granite	5.25/cy
Sand (granite)	4.25/cy
Sand (concrete)	7.00/cy
Crushed aggregate (St. Spec)	7.50/cy

Material Transportation Costs

Ground transportation – Transportation of materials to the barge for floating to Stehekin is $5.00/cy for gravel and sands; and $5.00/ton for rip-rap, which equates to approximately $7.50/cy.

Barge Transportation – The cost of barging sand, rock, or gravel from Chelan to Stehekin ranges from $17.00 to $35.00/cy. (Average $26.00/cy). Historical demand by private landowners for barged in mineral materials has averaged less than 100cy per year.

[The price summary table appears on the next page.]

CONCLUSION

The park management is in a position, similar to any supplier in the market place, to take advantage of the transportation cost differential in establishing a fair market value. If park management wanted to offer an incentive to use park resources, the choice would be to establish a low price by not including barge nor ground transportation costs. If the park management wanted to discourage park use, it would choose a price that equals the delivered competitive source which would establish a fair market value equal to the marketplace. A compromise, since local usage is small, would be to split the difference in transportation cost with the purchaser and set the price at total cost plus one half of the transportation charge. The final price schedule rests with the goals of the park and is a management decision. There is a logical price reasoning to justify the minimum, the maximum, and any price in between depending on the market strategy. Unless the private historic use changes, it may even be recommended that the price be set at zero (free use) because the cost of collection and monitoring may greatly exceed the revenue (an economic reality). The historic record of use, and the stability of the community (high growth rate does not appear to be a concern),

suggests that demand is inelastic. This means that demand is not a function of price but of growth. The community is not going to suddenly start using significantly more mineral materials just because price falls. Park management, given this information, is in the best position to select a pricing schedule or strategy which optimizes its overall goals.

PRICE SUMMARY TABLE

Commodity (wt #/cy)	Option 1 AT COST No Added Transportation		Option 2 COMPETITIVE MARKET Total Transportation		Option 3 DISCOUNT 1/2 Transportation	
	$/CY	$/Ton	$/CY	$/Ton	$/CY	$/Ton
Rip-Rap (2,600)	10.50	8.10	44.00	28.10	27.25	18.10
Washed Gravel (3,250)	8.00	4.90	39.00	20.90	23.50	12.90
Decomp. Granite (2,900)	5.25	3.60	36.25	21.60	20.75	12.60
Sand (Granite) (2,700)	4.25	3.15	35.25	22.40	19.75	12.75
Sand (Concrete) (2,700)	7.00	5.20	38.00	24.45	22.50	14.80
Crushed Aggregate (2,900)	7.50	5.15	38.50	23.15	23.00	16.65
Pit Run (3,000)	3.00	2.00	34.00	19.30	18.50	11.25
Simplified Version (Option 3)						
Large Rock >10" Rounded[1]	10.50	8.00	44.00	28.00	27.00	18.00
Processed Material	6.50[2]	4.50	36.00	25.00	20.00	15.00
Pit Run	3.00	2.00	34.00	20.00	18.00	10.00

[1] The National Park Service will not supply riprap from Company Creek pit, but can supply larger rounded rock greater than 10".
[2] Price equals average of processed material costs, excluding riprap, rounded to the nearest $.50.

APPENDIX F: COST ESTIMATES FOR THE COMPANY CREEK MINING PLAN AND RAINBOW PIT RECLAMATION PLAN

TABLE F-1: COST ESTIMATES FOR 10-YEAR MINING PLAN

Resource	Unit	Number of Units	Unit Cost	Total Cost
Planning				
Lake Chelan Sand, Rock, and Gravel Plan (includes NEPA compliance)				$40,000
Site Survey Work and Additional Planning (staking, CAD analysis/drafting, etc.)				3,500
Total				**$43,500**
Extraction and Crushing				
Equipment				
D7U dozer with operator	hour	96	$110.00	$10,560
Transport dozer			500.00	500
Crusher (includes transportation)	cubic yard	7,000	10.19	71,313
Total				**$82,373**
Reclamation				
Material				
Trees, shrubs, forbs	cone container	930	$1.50	$1,395
Trees, shrubs, forbs	1-gallon container	336	$3.00	1,008
Trees, shrubs, forbs	2-gallon container	42	$5.00	210
Seeds	pound	41	$20.00	820
Seeds	pound	11	$20.00	220
Excelsior Mat	square yard	5,808	$0.63	3,659
Fertilizer, Agriform tab	1,000-tab box (10 gm tabs)	2	$28.00	56
Fertilizer, slow release	50-pound bag (covers 7,500 sq. ft.)	7	$12.37	87
Topsoil, salvaged	2 days staff using park equipment			1,300
Topsoil, purchased	cubic yard (for 2-inch depth)	108	$55.00	5,940
Equipment				
Seed drill	Truax			8,500
Broadcast seeder	Truax	not included in total		1,700
Hand seeder/fertilizer spreader	Whirlybird or similar	4	$20.00	80
Dozer for regrading	hour	13.5	$110.00	1,500
Human Resources				
Topsoil salvage				See above
Topsoil replacement, preparation of seedbed				2,000
Seed collection				9,000
Seed planting				702
Plant planting				1,900
Mat installation				1,066
Water/alien species control	years (1-5)	5	$6,000.00	30,000
Water/alien species control	years (6-10)	5	$3,000.00	15,000
Total				**$86,143**
Monitoring and Remediation				
Material				
Miscellaneous material for remedial actions (fencing, seed, mulch, etc.)				$15,000
Equipment				
Miscellaneous sampling equipment (camera, measuring tapes, etc.)				1,500
Human Resources				
Sensitive wildlife survey	acres	640	$2.75	$1,760
Vegetation survey (including rare plants)	days	10	$83.60	836
Soil sample collection	days	1	$83.60	84
Archeological survey	days	5	$83.60	418
Aquatic resources	days	5	$83.60	418
Mining monitoring	days	15	$83.60	1,254
Plant establishment	days	30	$83.60	2,508
Other Costs				
Soil sample analysis	sample	4	$40.00	160
Total				**$23,938**
Total cost for 10-year mine plan				**$235,954**

NOTE: Cost estimates were based on 1995 dollar values and should be reevaluated on a regular basis to adjust for inflation and unknown factors.

TABLE F-2: COST ESTIMATES FOR 20-YEAR MINING PLAN

Resource	Unit	Number of Units	Unit Cost	Total Cost
Planning				
Lake Chelan Sand, Rock, and Gravel Plan		Cost included in 10-year mining plan		
Site Survey Work and Additional Planning (staking, CAD analysis/drafting, etc.)				3,500
Total				$3,500
Extraction and Crushing				
Equipment				
D7U dozer with operator	hour	96	$110.00	$10,560
Transport dozer			500.00	500
Crusher (includes transportation)	cubic yard	7,000	10.19	71,313
Total				$82,373
Reclamation				
Material				
Trees, shrubs, forbs	cone container	698	$1.50	$1,047
Trees, shrubs, forbs	1-gallon container	252	$3.00	756
Trees, shrubs, forbs	2-gallon container	32	$5.00	160
Seeds	pound	41	$20.00	820
Seeds	pound	8	$20.00	160
Excelsior Mat	square yard	5,124	$0.63	3,228
Fertilizer, Agriform tab	1,000-tab box (10 gm tabs)	2	$28.00	56
Fertilizer, slow release	50-pound bag (covers 7,500 sq. ft.)	7	$12.37	87
Topsoil, salvaged	2 days staff using park equipment			1,300
Topsoil, purchased	cubic yard (for 2-inch depth)	81	$55.00	4,455
Equipment				
Hand seeder/fertilizer spreader	Whirlybird or similar	4	$20.00	80
Human Resources				
Topsoil salvage				See above
Topsoil replacement, preparation of seedbed				2,000
Seed collection				9,000
Seed planting				702
Plant planting				1,600
Mat installation				1,066
Water/alien species control	years (1-5)	5	$6,000.00	30,000
Water/alien species control	years (6-10)	5	$3,000.00	15,000
Total				$71,608
Monitoring and Remediation				
Material				
Miscellaneous material for remedial actions (fencing, seed, mulch, etc.)				$15,000
Equipment				
Miscellaneous sampling equipment (camera, measuring tapes, etc.)				1,500
Human Resources				
Sensitive wildlife survey	acres	640	$2.75	$1,760
Vegetation survey (including rare plants)	days	10	$83.60	$836
Soil sample collection	days	1	$83.60	$84
Archeological survey	days	5	$83.60	$418
Aquatic resources	days	5	$83.60	$418
Mining monitoring	days	15	$83.60	1,254
Plant establishment	days	30	$83.60	2,508
Other Costs				
Soil sample analysis	sample	4	$40.00	160
Total				$23,938
Total cost for 20-year mine plan				$181,418

NOTE: Cost estimates were based on 1995 dollar values and should be reevaluated on a regular basis to adjust for inflation and unknown factors.

TABLE F-3: COST ESTIMATE FOR RAINBOW PIT RECLAMATION PLAN (IN-HOUSE NPS)

Resource	Unit	Number of Units	Unit Cost	Total Cost
Material				
Peat Moss	4-cubic-yard bales	200	$10.00	$2,000
Fertilizer				500
Equipment				
Chipper rental	week	3	$300.00	900
Truck rental				2,500
Truck bed replacement				9,300
Truck repairs				2,000
Dozer rental				4,000
Barge run				1,200
Human Resources				
Resource management technician	days	110	$83.50	9,200
Drivers		2	$3,600.00	7,200
Other Costs				
Travel expenses				1,200
Total cost for Rainbow Pit reclamation				**$40,000**

NOTE: Cost estimates were based on 1995 dollar values and should be reevaluated on a regular basis to adjust for inflation and unknown factors.

APPENDIX G: COST AND DISTURBANCE COMPARISON FOR GMP ALTERNATIVES

Table G-1 compares costs and maximum area of disturbance at the Company Creek Pit for each alternative sand, rock, and gravel plan described in the GMP for 20 years of operation. Table G-2 compares costs and disturbance of limited Lake Chelan NRA extraction (proposed action) to total NRA extraction (alternative C). For comparison purposes it was assumed that the maximum annual amount of material used under each alternative (except alternative A) would approximate the average annual amount used in the past (see table 5 in this *Sand, Rock, and Gravel Plan*). The maximum area of disturbance would be offset by a near equal amount of reclamation under each alternative.

TABLE G-1: COMPARISON OF COMPANY CREEK PIT OPERATION COSTS AND DISTURBANCE AREAS FOR ALTERNATIVE SAND, ROCK, AND GRAVEL PLANS DESCRIBED IN THE GMP

	Proposed Action	Alt. A	Alt. B	Alt. C
NRA sources (cy)	28,000	0	0	56,000
External sources (cy)	28,000	0	56,000	0
Estimated maximum consumption for 20 years (cy)	56,000	0	56,000	56,000
Cost for mining in the park	$417,000	$0	$0	$834,000
Cost for importing	$980,000	$0	$1,960,000	$0
Total cost for 20 years	**$1,397,000**	**$0**	**$1,960,000**	**$834,000**
Maximum acres of new disturbance	0.8	0	0	1.1

TABLE G-2: COMPARISON OF LIMITED IN-PARK EXTRACTION TO TOTAL IN-PARK EXTRACTION

	Cost	Disturbance Acres
Limited NRA Extraction (Proposed Action)	$1,408,000	0.8
Total NRA extraction (Alternative C)	$834,000	1.1
Difference for 20 years	**$574,000**	**0.3**

REFERENCES

National Park Service, United States Department of the Interior

1988 *Management Policies*. Washington, DC.

1990 *NPS Guidelines: Minerals Management* (NPS-66). Washington, DC.

1995 *General Management Plan / Implementation Plan Alternatives / Environmental Impact Statement for Lake Chelan National Recreation Area*. Denver, CO.

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-187 June 1995